# The Mining Journal

LONDON, JUNE 27, 1958

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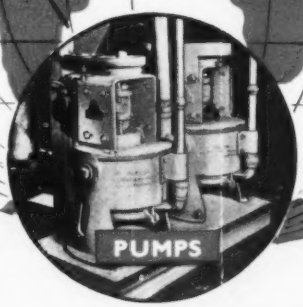


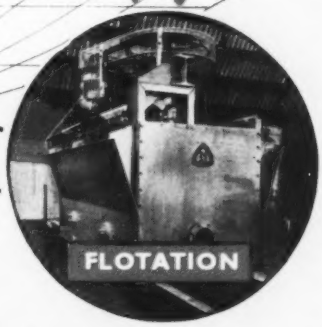


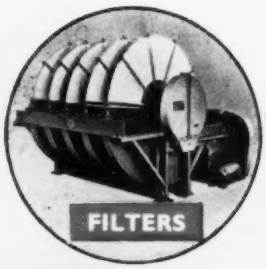


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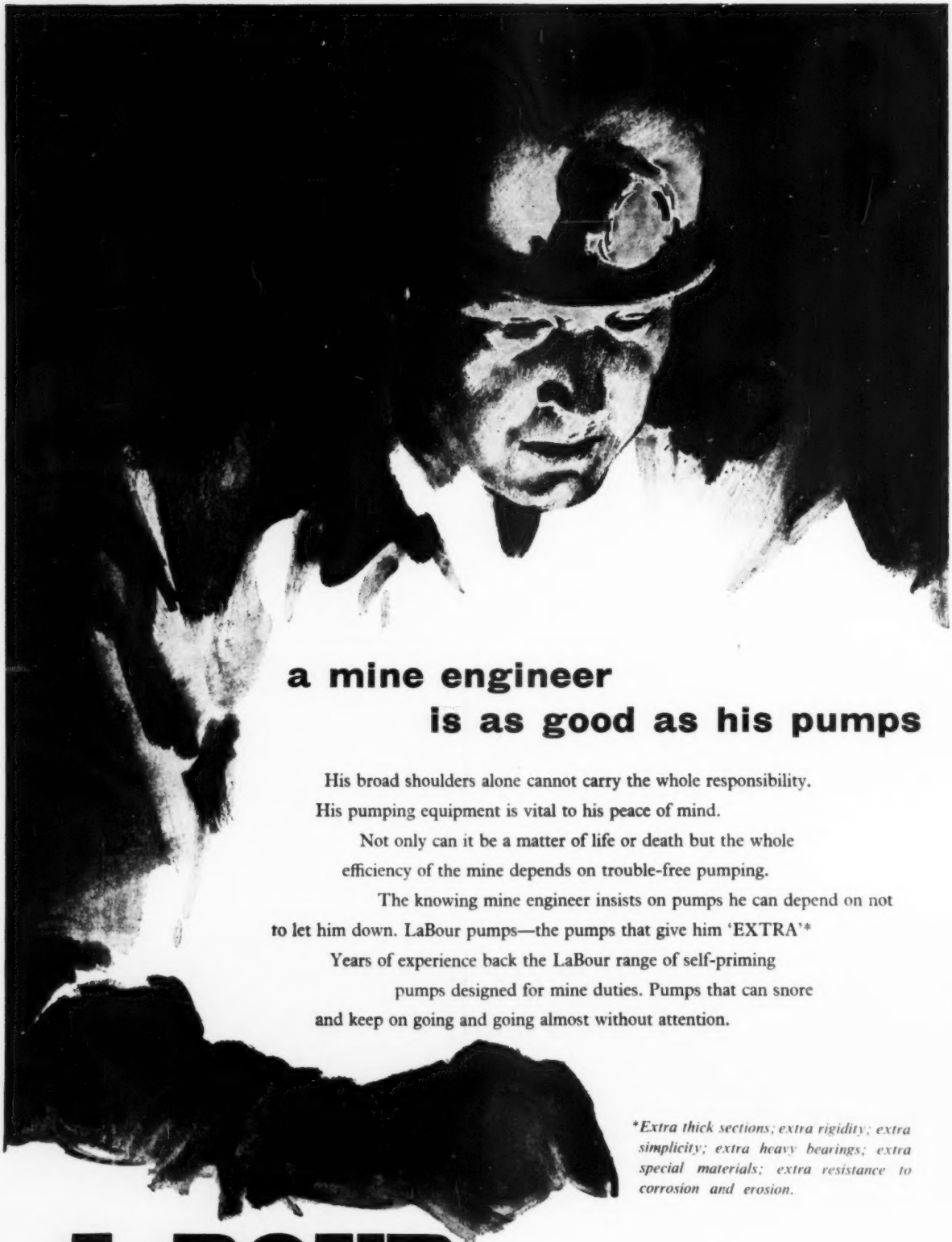

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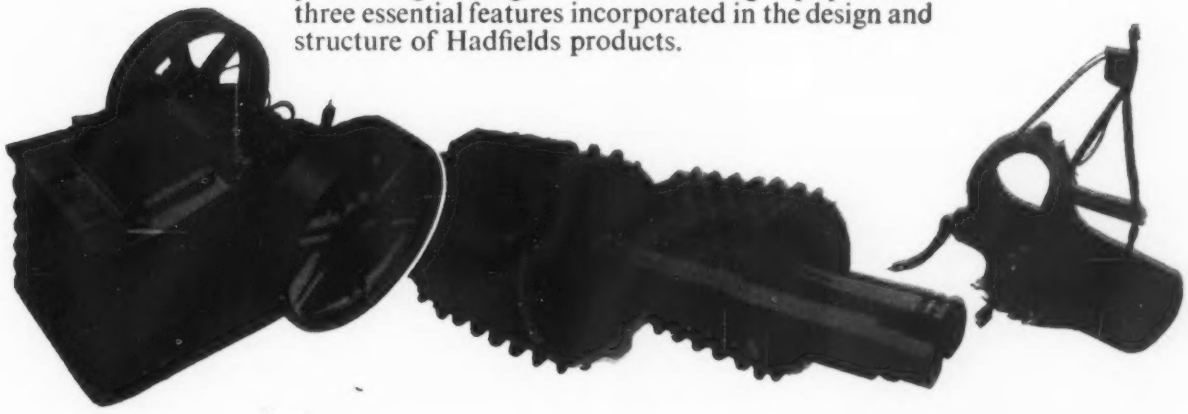

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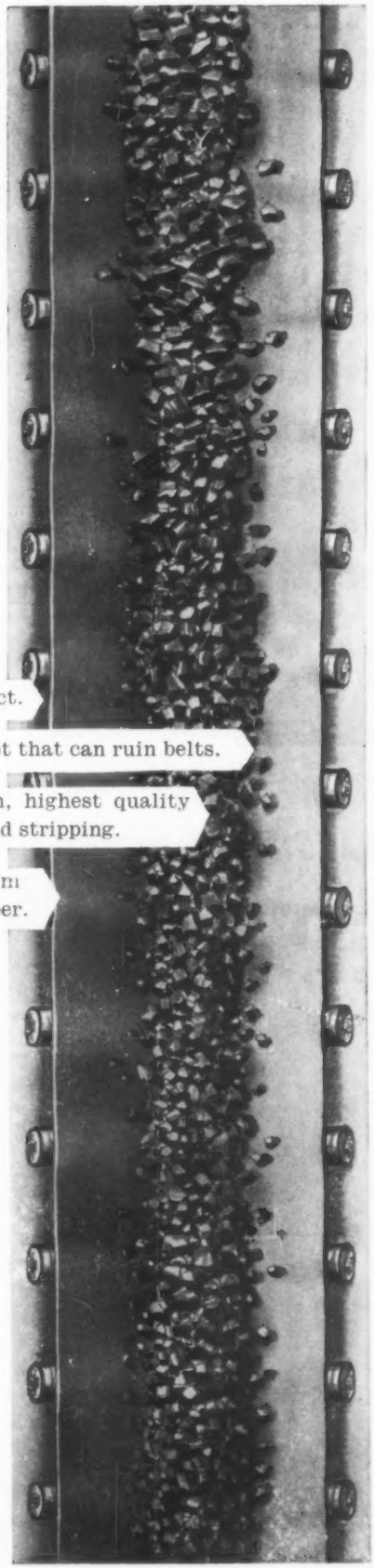

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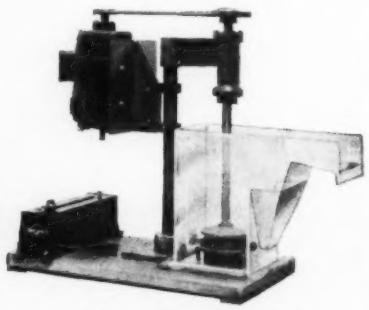

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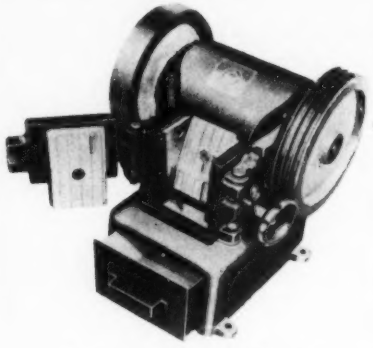

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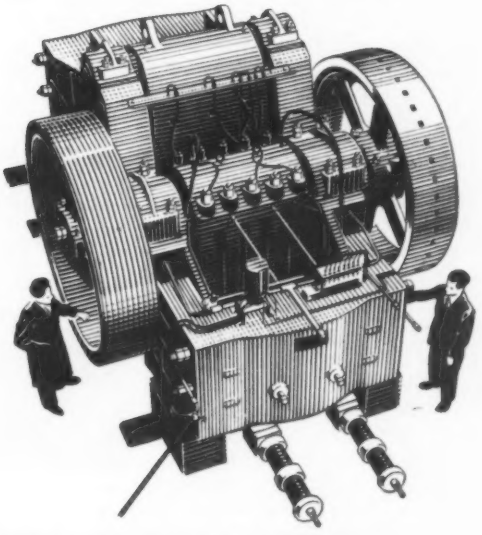

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# The Mining Journal

**London, June 27, 1958**

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## Will Russia Play Ball with the ITA?

THE turn of the tide for tin producers depends primarily on the revival of American demand. Meanwhile, the world market is being profoundly affected, both quantitatively and psychologically, by the consignments of Russian and Chinese metal, which keep on turning up whenever the price of cash metal shows welcome, but so far depressingly fleeting, signs of leaving the floor.

Estimates of Russian shipments to Britain and Western Europe during the first three months of 1958 appear to range from 3,000-4,000 l.tons. On the latter and most pessimistic basis, total exports for the current year would thus be 16,000 l.tons, equivalent to over 10 per cent of the total Free World consumption in 1957, which is placed at 157,500 tons.

Even on the no less pessimistic assumption that total world consumption falls by 18 per cent this year to 129,000 tons, it would still be large enough to absorb the drastically reduced flow from the I.T.A. countries (92,000 tons on the present quota basis), plus 16,000 tons from Russia and China, and a further 12,000 tons from other producers, leaving a deficit of 9,000 tons to be met from the buffer stock or by further running down consumer stocks. The present restrictions, however, are essentially a temporary expedient; certainly they cannot be held at their present levels indefinitely without grave detriment to the economies of producer countries. In the long run, supply must be brought into balance with demand not by reducing production but by an increase in world consumption. Last year world mine production, excluding the U.S.S.R. and China, was 164,000 l.tons. In order to absorb an output of this magnitude, plus 16,000 tons of Russian tin, Free World consumption would require to be 180,000 tons, this exceeding last year's figure by some 23,000 tons or 14.65 per cent. Viewed from this aspect the growth in Russian tin exports must be a source of considerable anxiety to Free World producers. The pill is, of course, no sweeter for the fact that Russian exporters are not merely increasing their share of the market but are also benefiting from the sacrifices which the I.T.A. countries are making in the interests of price stabilization.

Even more serious, perhaps, than the tangible impact of Russian tin is its psychological effect. In the absence of statistical information the I.T.C. made insufficient allowance for this source of supply when quotas were first introduced. Without statistical evidence it is impossible to determine whether Russian tin exports indicate a temporary or a structural surplus in the U.S.S.R. Do they represent the release of strategic stockpiles rendered unnecessary by changing concepts of military strategy? Is Russia deliberately seeking to sabotage the tin scheme? Or is she merely converting her surplus metal into foreign currency in the normal course of trade? Without the answers to these questions, there can be no certainty that Russian exports will not exceed expectations, and this uncertainty can scarcely fail to be damaging to the morale of I.T.A. producer members, apart from its effects on the market.

As an encouraging long-term pointer it has been suggested that rising living standards over the next few years should result in the

Russians using more of their tin at home. According to one recent statement, however, the U.S.S.R. is now producing as much tin as Malaya. This seems improbable, but we know so little about the Russian tin industry that no possibility can be entirely dismissed. If the U.S.S.R. is indeed producing some 60,000 tons of tin metal annually, it follows that she is likely to remain a large exporter for many years, since the U.S. consumed only 54,700 tons last year and Russian domestic consumption is almost certainly of a considerably lower order.

Faced with all these imponderables, the I.T.C. has taken the logical (perhaps inevitable) step of inviting the U.S.S.R. to join the Agreement. Economically, Russia is in a strong bargaining position, since she is already enjoying the benefits of the Agreement at no cost to herself. It would be for the Council to convince her that by setting a ceiling on her exports she would get more money for less tin. It might also be pertinent to point out that collapse of the quota scheme due to unilateral action by disheartened producer countries would inevitably result in a sharp contraction in price, which would certainly not be to the benefit of Russian exporters.

Politically, the U.S.S.R. has always affirmed its desire to help under-developed countries and its interest in international economic co-operation. On the former ground, Moscow might find it embarrassing to turn down the pleas of the producer members, whose welfare in the immediate future is so closely bound up with the success of the scheme. But if Russian exports are, in fact, primarily a form of economic sabotage (which seems improbable), the force of this argument might be blunted by the rejoinder that some of the most important consumer countries in the western world—notably the U.S., Western Germany and Japan—have remained outside the Agreement. America, it might further be pointed out, is prepared to stockpile copper in order to assist producers. By taking a very much smaller tonnage off the market, she could do the same with tin. Why should Russia be expected to pull capitalist chestnuts out of the fire? Certainly it would be difficult to base the appeal on the ground of international solidarity, unless the I.T.A. was much more fully representative of the Free World nations. In this connection it is interesting to speculate what the reactions of the principal states might be if Russia joined the I.T.A. The Council has instructed its chairman at a suitable time to request the United States, Japan, Western Germany and other countries he deems appropriate, to reconsider their attitude to the Agreement.

Another interesting question is whether, if Russia were to come into the Agreement, the export quotas of the six producing countries who are at present members would be further cut to allow for her participation, or whether the overall tonnage of permissible exports would be enlarged.

If Russia agreed to join the scheme, she would presumably be obliged to supply statistical information as to the production and consumption of tin within her boundaries. By eliminating much of the present uncertainty from the tin market, this alone would be an important gain.

If Russia persists in maintaining statistical secrecy, this obstacle to membership of the Agreement might conceivably be overcome by basing her quota on exports only without reference to production. Whatever the system adopted, it would be essential to ensure that exports of all Iron Curtain tin are brought under control, since it is quite conceivable that production and consumption in the U.S.S.R. might actually be in approximate balance, the metal exported originating from China or satellite countries.

Finally, it should be emphasized that, even if Russia is not prepared to co-operate with the I.T.A. countries, the possibility that the price of tin may soon improve can by no means be excluded, bearing in mind that world production, owing to the export restrictions, is now substantially below world consumption, and that the pipeline is only just beginning to run dry.

## ITALIAN QUICKSILVER IN 1957

The year 1957 saw a considerable decline in Italian exports of quicksilver metal, total exports aggregating 992 tonnes as compared with 2,586 tonnes in 1956; a fall of 61.6 per cent. As expressed in flasks, exports in the two years 1957 and 1956 totalled approximately 29,000 flasks and about 75,000 flasks respectively. Exports in 1957 absorbed less than half the output of metal, which amounted to 2,180 tonnes as against 2,135 tonnes in the preceding year, an increase of approximately 2.1 per cent.

Mercury ore mined in 1957 amounted to 365,000 tonnes, representing an increase of about 21.3 per cent over 1956 (301,000 tonnes).

From a recent report by Società Monte Amiata, the leading quicksilver concern in Italy, whose mines are concentrated in the Monte Amiata region (south-western Tuscany), it appears that the decline in exports which set in by the middle of 1957 is mainly due to reduced purchases by the United States, the largest buyer of Italian quicksilver, but some European countries have also reduced their purchases. As in former years the company urges the necessity of abolishing the burdensome production tax on quicksilver. That tax, adding to the costs of production, is felt to be a serious handicap since it places the Italian producers in an unfavourable position to meet international competition on the world market. Another negative factor, it is pointed out, is the present peculiar development of the international quicksilver market in which offers exceed the demand.

In view of the falling world price of quicksilver, Monte Amiata started on a programme of reduced mining activities early in 1958. Some mines in the Monte Amiata region, notably the Cortevecchia mine, have been placed on a care and maintenance basis, and a number of miners had to be dismissed, a fact which resulted in a conflict with the trade unions concerned. On the other hand, the company has launched a vast programme of prospecting in the Monte Amiata region with a view to the location of new deposits.

On the commercial side, Monte Amiata and the Siele company instituted early in 1958 a joint sales office for their products, known as "Mercurio Italiano", with a view to improving their position on the world market. Monte Amiata earned a net profit of Lire 312,622,236 in 1957, which enabled a dividend of Lire 240 per share to be paid. Monte Amiata owns a share capital of Lire 3,280,000,000 while the share capital of Stabilimento Minerario del Siele amounts to Lire 1,647,360,000.

## STIFFER STANDARDS FOR SAFETY AWARDS

The adoption of new and stiffer standards under which individuals, mines and mineral-processing plants can qualify for safety awards of the Joseph A. Holmes Safety Association was recently announced by Mr. Marling J. Ankeny, director of the Bureau of Mines, U.S. Department of the Interior, and president of the Association. The new award requirements, reflecting improved safety conditions

in the mineral industries, were adopted at the Association's annual meeting. Advances in technology and lessening of certain hazards, it was stated, have made it easier for an individual, mine, or plant to work for long periods without an accident.

The stricter requirements apply only to safety awards granted to individuals, mines and plants for outstanding attainments. Qualifications for individual and group hero awards remain unchanged.

Mechanical mining methods have resulted in increased output per man-shift. The Association, therefore, considers it more realistic to use man-hours worked—the exposure period—when comparing mine records and experiences. Awards based on tonnage produced without a fatality are accordingly abolished. Another change is that permanent total disabilities will be included with fatalities when considering safety achievements. Both represent a permanent loss of manpower and both receive equal consideration in computing severity rates.

The following minimum man-hours worked without a fatality or permanent total disability have been adopted: 2,000,000 (formerly 1,000,000) for underground mining operations; 3,000,000 (formerly 2,000,000) for open-cut mining, open quarrying, and petroleum-drilling operations; 8,000,000 (formerly 2,000,000) for plant and surface operations other than open-cut mines and quarries; 10,000,000 for the petroleum industry (except drilling), smelting and reduction works.

Minimum man-hours worked without a disabling injury are now as follows: 400,000 (formerly 250,000) for underground mines and petroleum drilling operations; 600,000 (formerly 350,000) for open-cut mines and quarries, plant and surface operations, the petroleum industry (except drilling), smelters and reduction works.

In Canada a special committee has been set up to investigate mining systems employed in the uranium mines of the Elliot Lake area, particularly in relation to methods of rock support. So far there have been 14 fatalities in mines of this district. The committee comprises the heads of the faculties of mining engineering at three of Canada's largest universities. The members are Prof. R. G. K. Morrison of McGill, Prof. A. V. Corlett of Queens, and Prof. R. H. Rice of Toronto. The committee will be given wide powers to make any recommendations that will result in safer operation.

## ISRAEL'S POTASH AND PHOSPHATE INDUSTRIES

The possibilities of increasing the potash extraction from the Dead Sea will be the main objective of an investigation by American engineers of the Zanzibar Construction Aggregates Corporation of Chicago, to be carried out on instructions of the government in a combined operation with the potash works. For this purpose, the government has allotted I£700,000 (i.e. about £140,000 sterling). The engineers of the American company have already conducted some research work on the chances of exploitation of Dead Sea resources. Possible erection of a dam near Sodom is being envisaged which would serve to accelerate the accumulation of salt substances. Test drillings of the Dead Sea bottom to establish the feasibility of expanding the potash evaporation will take about six months, but the whole investigation will require about a year. The sea bottom will have to be mapped. Waves, winds and floodwaters from wadis flowing into the sea will be measured, and soil samples taken to the Haifa Institute of Technology for investigation.

The first commercial shipload of potash from Israel Dead Sea Works, a consignment of 4,000 tons of muriate of potash, has recently arrived in Australia. Since this consignment has been found excellent by local fertilizer manufacturers, it is hoped that within a short time Israel will supply about 50 per cent of the total local consumption of potash.

Managers of the phosphate company at Oron in the Negev anticipate a considerable increase in phosphate exports; 5,000 tons of phosphates were recently exported, being the first consignment in the new budgetary year. A total of 55,000 tons was exported in the year ending March 31, 1958, as against 29,000 tons in 1956/1957. Production in 1957/1958 reached the figure of 181,000 tons as compared with 114,000 tons in 1956/1957.

A grant of I£200,000 was presented by the United States Ambassador to the Research Council of Israel to expedite a programme of research into methods of desalting sea water. It is expected that the research and development project will lead to an earlier refinement of water desalination techniques and to their practical application to Israel's problem of water supply. A further purpose of the financing of this project is to facilitate the flow of scientific data on desalination between agencies of the governments of Israel and the U.S.A., for their mutual information. The work on water desalting will be carried out at the Negev Institute for Arid Zone Research, recently established in Beersheba by the Research Council of Israel. The Institute is developing various facilities as well as an ecological garden and arboretum on a 140-dunam plot.

## THREE-YEAR PLAN FOR IRISH COALFIELDS

A three-year programme of drill testings will commence shortly in the Leinster and Connacht coalfields in the Irish Republic. The programme, which will be financed by the American Counterparts Fund, Ireland's share of Marshall Aid, will be carried out by the Irish Geological Survey Office.

The Leinster coalfield lies where the counties of Kilkenny, Carlow and Laois meet. It produces anthracite and is the larger of the two areas to be tested. Not far from this main coalfield, but in County Tipperary, there are smaller anthracite deposits known as the Slieve Ardagh coalfield. The exploratory work being planned will concentrate on the larger deposits because these are believed to be potentially richer.

Coal has been mined at several places in this region for about 300 years. In the 1930's total anthracite production was about 90,000 tons a year, but during the war when supplies from Britain were difficult to obtain, production went up to 120,000 tons a year and has steadily increased in the post-war years reaching 160,000 tons in 1957. More than 1,000 miners are employed in these mines.

The Connacht, or Arigna, coalfield is in County Leitrim and produces semi-bituminous coal. Production in 1957 was 80,000 tons. About 500 miners are employed at Arigna. The Irish Electricity Supply Board has recently completed a 15-megawatt generating station at Arigna, this will consume 45,000 tons of the local coal annually, and is an additional incentive that should expand production.

Ireland thus obtains about 240,000 tons or one-sixth of her total coal requirements from domestic mines. The policy of the Government of the Irish Republic is to increase the production of native coal and it is, therefore, expected that the proposed borings will reveal substantial additional deposits.

# Productivity in Malayan Tin Mines

OUR correspondent in Malaya points out that in *The Mining Journal* of May 23 appeared extracts from the Presidential Address delivered by Mr. J. B. Dennison, A.R.S.M., to the annual general meeting of The Institution of Mining and Metallurgy. Therein were some figures relating to productivity in the tin mines of Malaya which, our correspondent suggests, are rather misleading, in that the monthly rates of man tons shown are really the annual rates. Other inaccuracies have crept in, probably due to a relation of labour figures for mining as a whole to production from tin mining only.

However, Mr. Dennison is to be thanked for directing attention to the need for paying closer attention to productivity trends. In making his comparisons he took as his base the year 1946, which, as he admitted, was unfair. Although the rehabilitation of Japanese devastation was not complete in 1948, that is the latest year to form a base for a study covering a decade's figures.

The comparisons in this article are of averages for 1957 with those for 1948, for which years detailed statistics were kindly furnished by the Federation of Malaya Department of Mines. Mining methods are divided into six categories —dredging, gravel pumping, hydraulicking, opencasting, underground, and other methods. Each method will be considered separately.

### Dredging

An increase of 20.3 per cent in active dredges, from 64 to 77, produced 28.16 per cent more tin-in-concentrates—28,117 tons compared with 21,930 tons. Although working installations had increased in number, labourers employed fell from 14,179 to 14,038, that is by 0.99 per cent; productivity expressed in terms of man tons per annum rose by 29.03 per cent, from 1.55 to 2.00. Over the same period the h.p. of active machinery went up from 61,710 to 106,436, or 72.48 per cent, and production per h.p. fell by 27.78 per cent from 0.36 ton to 0.26 ton.

The Mining Enactment in force in Malaya provides that one h.p. of labour-saving apparatus shall be calculated as the equivalent of eight labourers. Accepting that as a basis for calculation, a man/h.p. unit can be arrived at by adding the number of manual labourers to eight times the h.p. We now have a man/h.p. figure of 507,859 for 1948 and 865,526 for 1957, an increase of 70.43 per cent. Expressed in tons of tin-in-concentrates per man/h.p., productivity dropped from 0.043 to 0.023, a decline of 25.58 per cent.

The inference is that taking the dredging section of the industry as a whole, whilst the production per dredge increased over the decade and there was a substantial improvement in manpower productivity, the labour force had not maintained its productivity in ratio to the additional machinery brought into use.

### Gravel Pumping and Hydraulicking

An average of 402 operating gravel pumps in 1948 produced 16,253 tons, whilst in 1957 an average of 599 pumps produced 24,396 tons. Thus an increased output of 50.10 per cent was obtained from 49.25 per cent more pumps.

The number of labourers dropped by 21.80 per cent from 22,252 to 17,402. Productivity in terms of man tons per annum rose by 91.78 per cent from 0.73 to 1.40. Horse power in use rose by 115.74 per cent, from 108,880 to 235,905, and the yield per h.p. dropped by 33.33 per cent, from 0.15 ton to 0.10 ton. The man/h.p. productivity dropped by 25 per cent from 0.018 ton per annum to 0.013 ton.

Operating hydraulic mines decreased over the decade from 22 to 13, that is by 69.23 per cent. Production fell by only 25.60 per cent, from 2,191 tons to 1,630 tons. Labour figures were 2,859 and 1,468 respectively, a fall of 48.65 per cent. Productivity in man tons per annum improved by 42.86 per cent from 0.77 to 1.10.

Active machinery, rated at 19,520 h.p. in 1948, had fallen to 11,641 h.p. in 1957, a drop of 40.36 per cent. Production per h.p. improved by 27.27 per cent from 0.11 ton to 0.14 ton. Man/h.p. productivity rose by 21.43 per cent, from 0.014 to 0.017.

### Opencasting and Underground Mining

A reduction from eight opencast mines (1948) to four (1957) was accompanied by an increase in production from 561 tons to 1,259 tons, an increase of 142.24 per cent. Labour numbers also increased from 1,241 to 1,483, or by 19.50 per cent. Productivity in terms of man tons improved by 88.89 per cent from 0.45 to 0.85.

Active h.p. went up by 156.47 per cent from 4,172 to 10,700. Production per h.p. fell from 0.13 tons to 0.12 tons, a drop of 7.69 per cent. Man/h.p. rose by 151.59 per cent and productivity in terms of tons per man/h.p. declined 12.50 per cent, from 0.016 to 0.014.

The greater part of the tin won by underground working comes from one large mine, but official statistics give the number of operating mines as 33 in 1948 and 25 in 1957, of which cave workings make up the greatest number. Production rose over the decade from 1,228 tons to 2,520 tons or by 105.21 per cent. Labourers employed rose by 4.23 per cent, from 2,905 to 3,028. Productivity in man tons improved from 0.42 to 0.83, that is by 97.62 per cent.

The added manual productivity was in this case accompanied by an increase in production per h.p. Active h.p. moved from 9,042 to 8,810, a decrease of 20.48 per cent, and production per h.p. went up from 0.14 tons to 0.29 tons, or by 107.14 per cent. In terms of tons per man/h.p. productivity improved by 112.50 per cent, from 0.016 to 0.034.

### Conclusion

In the Malayan tin mining industry as a whole, excluding dulang washers, the number of labourers fell from 44,436 to 37,660 over the ten years, a drop of 15.25 per cent. Production rose from 42,402 tons to 58,218 tons, giving increased productivity, in terms of man tons, of 65.56 per cent, from 0.96 to 1.55. Active h.p. went up from 203,985 to 375,048, an increase of 83.81 per cent and tons per h.p. fell by 33.33 per cent from 0.24 to 0.16. Man/h.p. productivity declined by 24 per cent.

A study of the foregoing figures discloses that dredging is by far the most productive method of mining. Gravel pumping is the second, still some distance behind, but the gap between the productivity per unit of labour is narrowing. The large increase in mechanization, in both methods, is not reflected in a correspondingly large increase in the productivity of labour.

*CANADIAN ZINC—II*

# *Canada's Zinc Resources*

**This is the second of two articles based on "Zinc in Canada with Comments on World Conditions", by R. E. Neelands and D. B. Fraser, of the Mineral Resources Division, Department of Mines and Technical Surveys, Mines Branch, Canada (Memorandum Series No. 137, 1958, price 50 c.). The first article appeared in our issue of June 20, 1958.**

ALMOST 50 per cent of the zinc produced in 1954, 1955 and 1956 was derived from zinc-lead ores and the remainder from copper-zinc, copper-lead-zinc and other zinc-bearing ores.

Of the total output of 423,619 s.tons of zinc in all forms produced in 1956, 221,855 was mined in British Columbia. Quebec with 87,904 s.tons was the second largest producer, followed by Saskatchewan (45,125), Newfoundland (37,140), Manitoba (18,100), Yukon (10,394), Nova Scotia (1,424), Ontario (1,500) and New Brunswick (177).

## Mining and Milling

Though many small mines, especially in British Columbia, have made important contributions to Canada's zinc output, much the greater part of the production comes from the larger operations. The general trend is to replace hand labour by the use of mechanical equipment in an effort to offset rising labour costs and to handle large volumes of ore efficiently.

Except for the open pit of the Sullivan mine at Kimberley, B.C., very little zinc ore is at present being mined in Canada by surface operations. In the past many, if not most, lead-zinc or copper-zinc mines in their initial stages operated open pits or side-hill excavations and no doubt this lower cost method will be used again in the preliminary stages of new mining developments. Most zinc ore production in Canada is now carried out by some form of blast-hole mining using diamond drills or percussion drills and sectional steel. Mining at the Sullivan mine is done partly by this method.

In trackless mining the use of diesel or electrically driven heavy equipment mounted on pneumatic tyres is the essential feature. The method is particularly adaptable in fairly flat-lying deposits such as those of the Jersey mine of Canadian Exploration Ltd., British Columbia, but it is also finding favour in the case of certain vertical orebodies such as occur at Barvue, Quebec.

At some mines a combination of one or more mining methods is used and there can be many ramifications involved in current practice to suit the requirements of mining different types of orebodies.

In most cases very fine grinding is necessary to free the zinc sulphide minerals from the associated iron, lead o copper minerals. Crushing followed by ball milling grinding is the usual practice.

Flotation is almost universally used today to effect a concentration of the important sulphide minerals. After adding reagents to suppress the zinc, the normal practice is to coat the lead or copper grains with a reagent which will cause them to float to the surface of a flotation cell upon aeration from below. The lead, copper, or both, are removed from the surface of the cell by mechanical means. The residual material is then reconditioned so as to activate the zinc sulphides for flotation. The flotation concentrates are thickened and filtered to reduce the moisture content as much as possible. Zinc concentrates generally average 50-60 per cent zinc and may contain up to 12 per cent moisture.

There is, of course, considerable variation in milling flowsheets. In some mills a bulk non-ferrous metal concentrate is first recovered and this is broken up to isolate the several economic sulphides as much as possible. At a few mills zinc is recovered first and other metals are concentrated by further treatment. In almost all cases a clean concentrate cannot be made.

The zinc ore reserves of Canada cannot be completely reported by deposits since some companies do not reveal the tonnage and grade of their reserves. For instance, ore reserves of the Sullivan mine have not been published in recent years. In 1940, they were unofficially estimated at 60,000,000 tons, averaging 7 per cent lead, 6 per cent zinc, and 2 oz. of silver per ton. It is regarded as probable that in view of new lower workings developed since 1947 the reserve position has been maintained, but that the average grade may be slightly lower and the zinc content now greater than the lead content.

Ore reserves at the Flin Flon mine, including five properties either wholly owned or controlled by Hudson Bay Mining and Smelting Co. in the Flin Flon area, were reported at the end of 1956 to be 15,222,000 tons averaging 3.18 per cent copper, 3.5 per cent zinc, 0.066 oz. per ton gold and 0.95 oz. per ton silver.

In 1955 the Sullivan and Flin Flon mines together produced 200,038 tons of zinc metal—nearly half the Dominion's zinc output of 433,357 tons. Their combined ore reserves account for about a third of Canada's total measured and indicated reserves, which are placed at 240,416,900 tons containing 16,691,300 tons of zinc, 8,033,800 tons of lead, 1,917,200 tons of copper and 401,118,600 oz. of silver. There is also a significant amount of inferred ore, especially in Yukon, British Columbia, Manitoba and New Brunswick, the total of which is in excess of 20,000,000 tons containing 1,400,000 tons of zinc and 300,000 tons of lead.

The Department of Mines and Technical Surveys, Canada, estimates the world's total reserves of zinc ore in terms of zinc content at 73,791,000 tons, of which Canada accounts for 22.4 per cent.

## Properties Under Development

During the past several years Hudson Bay Mining and Smelting Co. has discovered and partly explored a number of deposits in Saskatchewan near Flin Flon and in Manitoba near the town of Snow Lake, 70 miles east of Flin Flon. It is reported that of these deposits the company will proceed first with production plans for the Birch Lake Mine (its ore contains no zinc), the Coronation mine, and the Chisel Lake mine.

The Coronation deposit was discovered by an electromagnetic survey during the winter of 1952-53. It is a copper sulphide replacement deposit in altered andesite, with minor zinc mineralization. The maximum width is 60 ft. and the average 20 ft. The length is 300-700 ft. and the vertical depth 1,200 ft. A shaft has been sunk to 1,350 ft. and 9 stations have been established at 150 ft. intervals. Cross-cuts have been driven on the 750- and 1,350-ft. levels.

A 15-mile standard gauge railway has been built from the mine to Flin Flon, where the ore will be shipped for treatment. Production is planned for the summer of 1959 at 1,000 tons a day. Ore reserves are 800,000 tons averaging 5 per cent copper and 0.4 per cent zinc.

Hudson Bay's Chisel Lake orebody, 70 miles east of Flin Flon, was discovered by an electromagnetic survey early in 1956. By diamond drilling an orebody of 3,800,000 tons was outlined by July, 1956, the grade being 11.0 per cent zinc, 0.91 per cent lead, and 0.42 per cent copper, with some gold and silver. The orebody is covered by 10 ft. of lake water and 140 ft. of lake bottom overburden. A three-compartment shaft was to be sunk in 1957 and production is planned for 1960.

**Ontario and New Brunswick**

Production of copper and zinc concentrates was started by Geco Mines Ltd. in September, 1957. This company's property comprises 46 claims covering over 1,700 acres on the north side of Manitouwadge Lake, Ontario. Ore reserves at the end of 1955 were estimated at 15,227,251 tons averaging 1.76 per cent copper, 3.48 per cent zinc, 12.21 per cent pyrites and 1.77 oz. silver per ton. The mine has been developed by a main production shaft to a depth of 1,500 ft. It has seven levels at 200-ft. intervals, the deepest being at 1,450 ft. A 3,300-ton concentrator has been constructed.

Adjoining the Geco property, on the west, is that of Willroy Mines Ltd. consisting of approximately 1,120 acres. Ore reserves in March, 1956, amounted to 2,160,000 tons averaging 1.09 per cent copper, 6.29 per cent zinc and 1.72 oz. silver per ton. Construction of a 1,000 ton mill was started in 1956 and production of copper, zinc, and lead concentrates began in August, 1957. The mine is being developed by two shafts.

The Errington and Vermilion Lake properties situated near the western end of the Sudbury basin are controlled and operated by Consolidated Sudbury Basin Mines Ltd. Ore reserves at the two properties were estimated in January, 1957, to be 16,500,000 tons averaging 1.2 per cent copper, 1.0 per cent lead, and 4.0 per cent zinc. Construction of a 3,000-ton per day concentrator began at the Errington mine in 1956 and production was planned for 1957. The Vermilion Lake ore will be transported 6½ miles to the concentrator by aerial tramway. Owing to market conditions, plans for production were suspended in September, 1957.

Large base metal deposits are under development in the Bathurst area, New Brunswick.

Plans have been announced by Brunswick Mining and Smelting Corporation Ltd. for bringing the Austin Brook and Anacon deposits into production jointly at a rate of 4,000 tons a day and to produce zinc, lead and pyrites concentrates. The Austin Brook property is situated 16 miles south of Bathurst. The deposit has a length of 1,100 ft. and an average width of 140 ft. About half the overburden has been stripped and it is estimated that about 6,000,000 tons can be mined by open-pit methods to a depth of 200 ft. A 150-ton pilot mill was built on the property in 1954 and began treating ore from the company's Anacon deposit, which is of a similar type, in February, 1955. Ore reserves indicated by drilling to a depth of 1,000 ft. total 28,312,000 tons averaging 4.1 per cent zinc, 1.6 per cent lead and 0.4 per cent copper. The Anacon, about 4½ miles north of the Austin Brook deposit, was found early in 1953 near a marked magnetic anomaly. To a depth of 1,000 ft. the ore reserve is estimated to be 27,440,000 tons averaging 5.3 per cent zinc, 1.9 per cent lead, 0.6 per cent copper, and 1.8 oz. per ton silver. A shaft has been sunk to a depth of 412 ft. and levels established at 200 and 350 ft. Development work is proceeding on these levels.

New Larder "U" Island Mines Ltd., a subsidiary of Anacon Lead Mines Ltd., acquired the Middle Landing property of 2,320 acres in 1952. It is roughly 14 miles south of Bathurst and 6 miles east of the Austin Brook property. A 1,500-ft. shaft was begun in September, 1954, after diamond drilling had indicated reserves of 1,173,000 tons averaging 8.2 per cent combined zinc and lead to a depth of 1,200 ft. Development was suspended in February, 1957.

American Metal Co. is developing a zinc-lead-copper sulphide deposit on the Little River property, 12 miles southwest of Austin Brook. Heath Steele Mines Ltd., a subsidiary of American Metal and International Nickel, was formed in 1955 to develop the property to production. One orebody is estimated to contain 4,200,000 tons averaging 7.1 per cent zinc, 1.2 per cent lead, and 1.3 per cent copper. Both estimates are based on drilling to a depth of 600 ft. In February, 1957, regular production began from two open pits and a 1,500-ton mill produced copper, zinc and lead concentrates.

Numerous zinc-lead occurrences have been found in Nova Scotia, but with the exception of the Stirling mine in southern Cape Breton Island no deposits of economic importance have been located. Since 1953, Cape Breton Metals Ltd. has carried out an exploration programme on a number of mineralized belts containing zinc, lead and copper sulphides. Some encouraging results have been obtained.

**The Northern Regions**

In the Northwest Territories a property on the south shore of Great Slave Lake, between the outlets of the Slave and Hay rivers, is being developed by Pine Point Mines Ltd., a subsidiary of Cominco with Ventures Ltd. The property has been explored by drilling and two shafts have been sunk, from one of which 660 ft. of lateral development has been done. The grade of ore varies considerably throughout the mineralized belt; the ratio of zinc to lead is generally 4 to 1, but in some sections lead predominates. Unofficial reports indicate an ore potential of 120,000,000 tons (about 5,000,000 tons being available for open-pit mining) with an average grade of 7.4 per cent zinc and 4.0 per cent lead. Preliminary ore dressing tests have shown that high grade zinc and lead concentrates can be produced. Tentative plans to bring the property into production include a concentrator to treat 10,000 tons of ore a day. Production, however, is predicted on the building of 430 miles of railway from Grimshaw, Alberta, to the property, over which concentrates would be transported for treatment at Trail.

The Mayo area has been the most thoroughly prospected base-metal district in the Yukon and probably contains more potential mines than all the other know areas in the territory. It extends over a length of 14 miles and averages 3½ miles in width. Most of the deposits are on property owned by United Keno Hill Mines Ltd., but there are many silver-lead-zinc occurrences on claims held by other interests.

Elsewhere in the Yukon, Vangorda Mines Ltd., a subsidiary of Prospector Airways Ltd., has partly developed a zinc-lead deposit on Vangorda Creek, a tributary of the Pelly river about 110 miles northeast of Whitehorse. Diamond drilling in 1954 and 1955 disclosed an ore zone of 9,400,000 tons averaging 5 per cent zinc, 3 per cent lead, and 1.76 oz. per ton silver. At Jeff Lake, 230 miles northeast of Whitehorse, Hudson Bay Mining and Smelting, through its wholly-owned exploration subsidiary, has out-

lined a fine-grained sphalerite and galena replacement body in bedded limestone containing about 9,000,000 tons of low-grade silver-lead ore. The McMillan property, located at the west end of Quartz Lake, 240 miles east of Whitehorse, has been explored extensively by the American Smelting and Refining Co. About 1,000,000 tons containing 10 per cent zinc, 5 per cent lead, and 1.18 oz. per ton of silver have been outlined by drilling.

At the two Canadian zinc plants, High Grade and Special High Grade electrolytic zinc are produced. One Canadian producer turns out Prime Western by adding the requisite amount of lead to his High Grade product.

About 20 to 25 per cent of Canada's refined zinc production is sold and used in the domestic market. Since 1946 the annual consumption has averaged 51,350 tons. The outlook appears to indicate a general increase in consumption in keeping with the forecast for increased output of steel products and other manufactures. The Canadian price generally conforms to the U.S. price for Prime Western zinc f.o.b. East St. Louis, Illinois, subject to monetary exchange adjustment. Canadian imports of zinc are relatively small and largely consist of zinc manufactures and chemical compounds.

The U.S. tariffs are of great significance to Canadian zinc producers, since the U.S. is Canada's principal customer for both refined zinc and zinc concentrates. Since 1954 there has been considerable agitation on the part of some U.S. producers to have the duties increased, which culminated in the recent enquiry by the U.S. Tariff Commission and the Administration's proposals for metal subsidies as an alternative to tariff increases.

Canadian zinc metal is marketed by the producers in Canada and by their agents in foreign countries. Both Cominco and Hudson Bay Mining and Smelting Co. Ltd. maintain sales research staffs who keep closely in touch with industrial consumers of zinc in order to advise and assist where possible in the best application of the metal and its alloys.

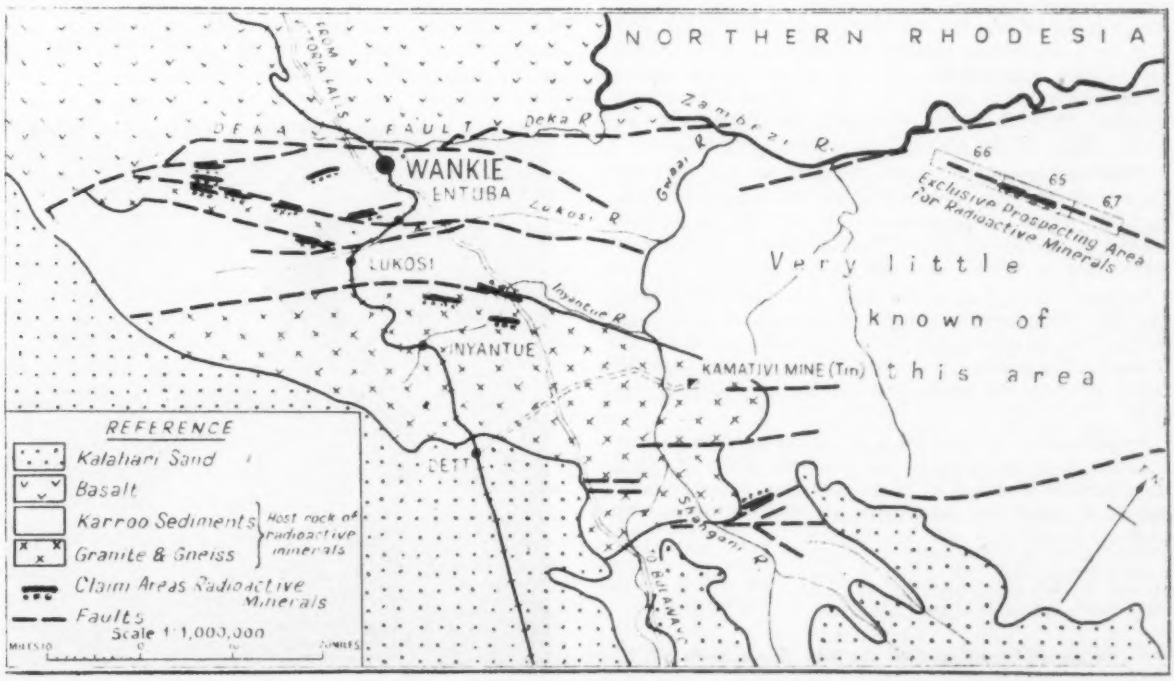
# *Southern Rhodesian Radioactive Occurrences*

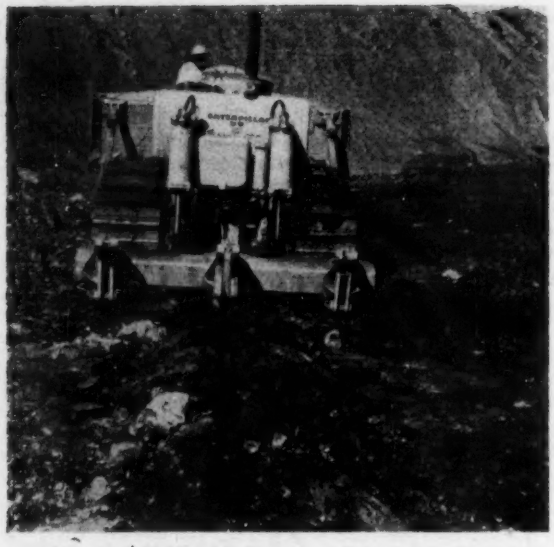
IN the Wankie Colliery area of Southern Rhodesia, a number of radioactive finds have caused an extensive prospecting campaign. The value of these occurrences is as yet unknown. Dr. F. L. Amm, of the Southern Rhodesia Geological Survey, has published a preliminary report after reconnaissance of the area, which shows their distribution to be associated with a wide zone of N.E.-S.W. faulting, but there are also indications of bedded horizons within the Karroo sediments being sufficiently radioactive to warrant further investigation.

In the north-eastern part of the area certain of the radioactive occurrences have been shown to contain thorium in association with barytes. In the Wankie area the radioactive element is uranium in association with fluorspar. Knowledge of the area is insufficient to show if this indicates a zonal distribution of the radioactive elements.

In general, the uranium content indicated averages under 1 lb. per ton, although isolated hot spots have given considerably higher figures. This is the result of only random outcrop sampling and based on radiometric readings. The extent of the outcrop leaching, and the grade of the primary ore in the unweathered rock has yet to be determined by exploration in depth. Until this is done it will not be known whether the field has any promise for economic development.

The new mineral field is of approximately 4,000 sq. miles in extent, but served by hardly any roads at all. The only reasonable approach to examination of such a large area will be by airborne scintillometer survey if advantage is to be taken of the price guaranteed until March, 1959.





**Working in a 30-in. seam of coal, the tractor ripper with 28-in. penetration was used as a replacement for a pinning machine**

# Ripping Opencast Coal for Loading

BREAKING opencast coal seams with a tractor-mounted ripper is proving an effective and economical aid in keeping production costs to a minimum at pits in Illinois, Pennsylvania, Kentucky and Missouri, where the new technique has been given thorough testing. These pits are reported to have realized definite benefits over ordinary methods of breaking the seam. Rippers mounted on crawler tractors have shown more versatility, more production per hour and less cost.

Ripping as a production technique was made possible by the recent development of large hydraulically-controlled rippers mounted on the rear of tractors in the over 300 h.p. class developed over the last few years. The combination of these two machines permits the ripper to utilize the tractor's weight and power. Unlike former towed rippers which simply trailed the prime mover and exerted no down pressure, the tooth on the mounted ripper concentrates the entire weight of the tractor for maximum penetration.

With tractor weights approaching 70,000 lb., only the tractive effort of the prime mover and the size of the tooth limit the depth of penetration. Ability of the modern crawler to develop up to 54,000 lb. of pull at the drawbar makes ripping possible in seams up to 6 ft. thick.

Complete fracturing of the seam can be obtained with the new technique. During the passage of the tooth through the seam the coal is not only broken at the point of the tooth's passage but lateral fractures, caused by the lifting action of the tooth, spread to the area between furrows.

Proper results in ripping depend on the establishment of a pattern to fit the needs of the particular mine. As each seam presents a unique set of specifications, no set formula can be arranged and each system must be developed by trial.

Using the procedure for thick coal, a Kentucky mine saves $27,000 a year by ripping a 6.3-ft. seam. The block measures 90 ft. wide and 200 ft. long. It takes 69.64 min. for one tractor to break the coal, resulting in a production of 3,610 tons per hour based on a 60-min. hour. After the tractor completes the ripping, it joins two other 300-h.p. tractors in stripping overburden. The three machines handle 60 per cent of the overburden at the mine.

This added versatility for the seam-breaking machine results in reduced costs. One machine and one man can complete a variety of jobs and it is not necessary to have expensive equipment standing idle during other operations. Other benefits result. In pits where no blasting is done, the ripper, built to withstand heavy shocks encountered during operation, cuts shovel stresses and reduces maintenance compared to loading off the solid. Such shock reduction can result in longer life for high-cost shovel components. In addition, breaking the seam increases the overall loading efficiency. One factor is reduction of voids. Another is less loading time per haul unit, giving increased haulage efficiency.

Even though the tractor-mounted ripper does save money over other methods by its versatility, the biggest economy is in actual production work. In pits where the technique was tested, results have shown marked cost and work reduction per ton.

Although it is able to shatter the coal completely, the tractor-mounted ripper does not produce an excess of fines. In most instances fines production ranges from less to no increase.

The Caterpillar Tractor Co., whose operations in this field have been reported in *Coal Age*, state that the new technique can break coal to full depth with substantial savings compared to shooting or pinning.

**Close-up illustration of the 8-ft. ripper tooth**

# MINING MISCELLANY

Great Lakes area freight car loadings in the third quarter are expected to decline by 27.8 per cent from the corresponding period of 1957.

★

The West German member of the European Coal and Steel Pool's High Authority, Dr. Franz Bluecher, has left for the United States, where he will negotiate a $40,000,000 loan for the coal and steel industries of the six member countries.

★

The first mail postmarked "Thompson Manitoba" was dispatched on June 18, soon after the opening of the Thompson Post Office. Located in the Thompson plant site area, the post office will serve construction workers and others during the construction stages of INCO's huge new mining project.

★

According to reports from Tromso, the Ivex Corporation Ltd., with Canadian and American capital, will carry out trial workings of the copper ore deposits at Repparfjord in West Finmark, Norway.

★

The Three Bells Mining and Milling Co., of Lordsburg, New Mexico, is starting active operation of its properties in the Burro Mountains, New Mexico, which consist of seven old Spanish gold mines. Gold, silver, and lead will be produced.

★

Mineral production for 1957 reached the highest total in Philippine history, being valued at P.227,497,451, of which P.155,350,903 was for sales of precious and base metals and the balance for non-metallic minerals.

★

Dominion Steel and Coal Corporation, the Canadian producer in which A. V. Roe (Canada) Ltd. has a controlling interest, is to curtail its colliery activities.

★

The United States Smelting, Refining and Mining Co. is closing its lead smelter at Midvale, Utah, due to lack of sufficient smelting ore and concentrates production.

★

A power plant and machinery will shortly be installed at the Belingwe emerald claim, Southern Rhodesia, to open it up as a full-scale emerald mine. A blockhouse in which the emeralds will be sorted and stored will be built on a nearby hillside. A Bulawayo report states that a smallworker's wife has discovered an emerald deposit in the Insiza River district, which "might eventually approach the Belingwe claim in size". Situated on what is now known as the Pepper Mine, eleven miles south-east of the Filabusi Post Office, the claim was originally pegged for molybdenite.

★

Japan has discovered uranium ore in Antarctica, according to Dr. Satsuo Aachimi, a member of a Japanese team which visited Ongul Island. The ore was said to be pitchblende with a 40-50 per cent uranium content.

★

La Luz Mines Ltd., of Nicaragua, expects its Rosita copper-gold project to go into production in October or November of this year. The property contains an estimated 3,582,000 tons, averaging 2.91 per cent copper and 0.027 oz. gold.

★

The U.S. Senate Finance Committee has voted to raise depletion allowances of gold mining companies from 15 per cent to 23 per cent. The proposed increase was included in some twenty-five provisions which the Senate group added to the technical tax revision Bill passed by the House earlier this session.

★

The value of minerals produced in Southern Rhodesia during the first four months of this year was £8,788,073, or 8 per cent more than for the same period last year. Asbestos—£3,058,890—was up 6½ per cent in value and 3 per cent in tonnage. Gold was valued at £2,239,289, which is a 1 per cent increase in value and weight. Chrome was up to £1,527,928—a 21 per cent increase in the 1957 value. Both copper and tin production are three times what they were last year. Although lithium minerals were down 8 per cent in tonnage, the value increased by 21 per cent. According to the Secretary for Mines, there is reason to hope that the mining industry of Southern Rhodesia will achieve another record production this year.

★

India produced minerals worth Rs. 1,257,000,000 (£94,300,000) during 1957, according to provisional estimates released by the Indian Bureau of Mines. An increase of Rs. 175,000,000, or 16 per cent, compared to the previous year is attributed to higher production of coal, iron ore, lead and zinc ore, limestone and salt. Coal, with an output of 43,500,000 tons, valued at Rs. 814,000,000 tons, was the leading mineral product.

★

Consolidated Mining and Smelting Co., a leading Canadian producer, has announced that it is planning an approximate 20 per cent cutback in lead production for the remainder of the year in view of the currently depressed price of this metal. The cutback is to start with a three-week shutdown at the company's lead refinery at Trail, British Columbia.

★

A new compressor plant, described as the biggest and most up-to-date in central Europe, began work last month at the Tatabanya coalfield in Hungary. The two units produce a total of 30,000 cu. m. of compressed air an hour and provide air for eight shafts. The machines were made in the U.S.S.R. and were assembled by Hungarian technicians.

★

A mining concession in Portuguese East Africa has been granted to Mr. A. de Figuereido, of Nampula. It covers prospecting for columbite, beryllium, lepidolite, bismuth, mica and manganese, but excludes oils and radioactive minerals. The concession runs for two years and calls for the formation within six months of a company with a minimum capital of £25,000.

★

Mexico's output of sulphur continues to rise and it is expected that this year it will reach 1,233,158 l.tons. There are now three Frasch system extraction plants in operation plus the Pemex gas separation plant at Poza Rica, State of Vera Cruz, and a hand-mining plant at Los Cerritos, State of San Luis Potosi.

**The headgear of the recently completed Eaton Turner shaft at Ashanti Goldfields Corporation. This 18-ft. dia. concrete-lined shaft is 4,354 ft. deep, and will be used for the exploitation of the mine's lowest levels, values on which have ranged as high as 46.1 dwt. over 13 ft.**

★

The Ecuadorean Ambassador, Sr. Jose Chiriboga, has disclosed the signing of a contract between his country and two United States firms for the development of Ecuador's mineral resources. The contract calls for the export of 2,000,000 tons of high-grade magnetite-ilmenite for a year for the next thirty years from Ecuador to the United States. The companies involved are Kyanna Oil Co., of Evansville, Indiana, and Universal Mineral Resources Inc., of New York.

## PERSONAL

Mr. H. W. Boyne has joined Colloidal Graphite Ltd., of London and Sheffield, as technical sales representative. Until recently he was home sales manager of Arthur Balfour and Co. Ltd.

★

Mr. K. S. Estlin has been appointed cable sales manager of Siemens Edison Swan Ltd.

★

Oldham and Son Ltd., electrical and battery manufacturers of Denton, Manchester, announce that Dr. C. D. J. Statham, who has hitherto controlled their mining division, is now to be responsible for the whole of their sales activities as general sales manager.

## COMPANY EVENTS

The non-ferrous division of Frank Samuel and Co. Inc. has changed its address to Suite 2607, 500 Fifth Avenue, New York 36, N.Y. The new telephone number is Pennsylvania 6-5577 and the new cable address Nykarmas-New York.

★

From June 30 the address of the Mid-

lands branch sales office of Borax Consolidated Ltd. will be Griffin House, 18-19 Ludgate Hill, Birmingham 3. The telephone number, Birmingham Central 2328, is unchanged.

★

Mine Safety Appliances Co. is taking over a second factory building at the Queenslie Industrial Estate, Glasgow, in July. When the new factory is in full production, the present labour force of 260 will be doubled.

★

Associated Chemical Companies Ltd. announce that, as from July 1, the sales of products manufactured by British Chrome and Chemicals Ltd. and Brotherton and Co. Ltd. will be handled by a newly formed subsidiary company, Associated Chemical Companies (Sales) Ltd., with its registered office at Brotherton House, Westgate, Leeds 1 (P.O. Box No. 6, telephone 29321-8, telegraphs Aschem Leeds).

★

Two A.E.I. divisions become operative on July 1. They are the A.E.I. turbine-generator division, managed by Metropolitan-Vickers Electrical Co., and the A.E.I. heavy plant division, managed by the British Thomson-Houston Co. These divisions will handle the design, manufacture, and sales of all products falling within these categories. They are the first A.E.I. divisions to be formed, following the chairman's announcement, at the time of the annual general meeting, of the proposed change to an A.E.I. divisional organization based on products. The headquarters of the turbine-generator division is at Metropolitan-Vickers, Trafford Park, Manchester 17, and that of the heavy plant division at British Thomson-Houston, Rugby.

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On June 30, H.M. the Queen will be touring Fife and during the day will visit Rothes Colliery, which is probably the most advanced structure of its type in the world. It is noteworthy that an entirely British concern, the British Reinforced Concrete Engineering Co. Ltd., of Stafford, were engineers for all the reinforced concrete work at the site with the exception of the coal washery.

## CONFERENCES AND EXHIBITIONS

On Tuesday of this week, the Mond Nickel Co. Ltd. showed to representatives of the Press its film "Refining Nickel from the Sudbury Ores", the third in the Inco series of sound-colour films describing the company's nickel operations. Two further films are in course of preparation to complete the series. "Refining Nickel from the Sudbury Ores" was produced for Inco by Film Graphics Inc., New York. It is in 16 mm., sound and colour, and runs for fifty-two minutes. The film is available on free loan. It is an excellent production, well in keeping with the reputation established by its predecessors.

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The NAPT Commonwealth Chest Conference, incorporating the annual conference of the British Tuberculosis Association, will be held at the Royal Festival Hall, London. From July 1-4, 1958, there will be lectures, discussions, and clinical meetings. From July 5-7, visits to hospitals, clinics and rehabilitation centres will take place, as well as tours of general interest. There will also be an exhibition. The conference is open to all interested in preventive medicine.

# Indian Symposium on Mineral Beneficiation

The papers presented at the symposium on mineral beneficiation and extractive metallurgical techniques, held at the National Metallurgical Laboratory, Jamshedpur, India, from February 8 to 11, 1957, have been published in a special issue of the *Indian Mining Journal* (1957). In all, 52 papers were presented covering ore dressing of both ferrous and non-ferrous ores as well as thermal beneficiation, hydrometallurgy and pyrometallurgy, but the emphasise is perhaps on ferrous and manganese treatment.

"The Beneficiation of Manganese Ores" (Harishchandra, Karkare and Borooah) is a very complete review of the treatment of low-grade manganese ores, showing methods investigated in the National Metallurgical Laboratory, India, and by the U.S. Bureau of Mines, and discussing the difficulties of translating the laboratory flow-sheet into plant practice. All the common methods such as washing and tabling, H.M.S. and flotation, and magnetic separation, are discussed, as well as phosphate removal, whilst treatments tested for ores containing high silica and low iron, high silica and high iron, high calcite and high iron, only are described.

In a paper entitled, "Differential Magnetization of Leucozene", by R. Krishnaswamy, it was shown that a reduction roast with carbon at a temperature of 600 to 700 deg. C. improved the magnetic properties of the leucozene when it can be separated from rutile with which it is associated in beach sands.

Investigations carried out on fused anhydrous aluminium chloride were reported by E. G. Ramachandran which indicate that aluminium metal can be obtained by electrolysis, whilst it is possible to chlorinate ferrugineous bauxites if carried out on a mixture of the bauxite and powdered charcoal or an initially sulphided bauxite.

In another paper the study of the production of uranium from chemical reduction and electro-chemical methods was described using potassium uranium fluoride, uranium tetra-fluoride and uranium chloride. Metal samples prepared by electrolysis of uranium fluoride were over 95 per cent pure, but samples prepared by chemical reduction were over 99 per cent pure.

A plan for extracting both copper and sulphur from chalcopyrite was described in which an intimate mixture of the ore concentrate and cupric chloride is heated producing cuprous chloride and elemental sulphur, provided air is excluded. Pure cuprous chloride is then obtained by solution in brine and electrolysis, and it is claimed that the production of copper from a cuprous solution requires only half the electrical energy required for a cupric electrolyte.

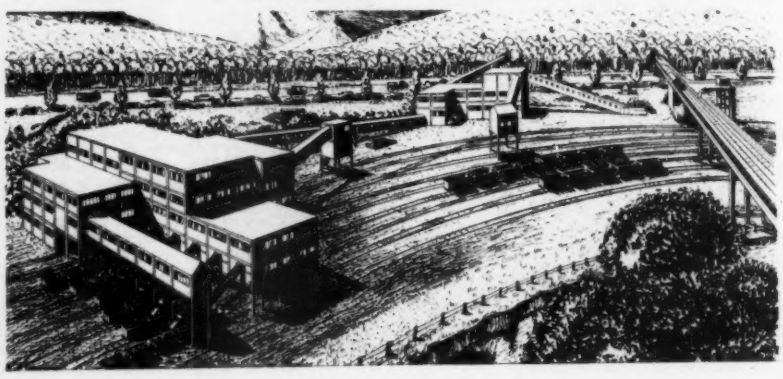
A description of an electrolytic extraction method for beryl was given in which the mineral is converted to a soluble salt which is electrolyzed between two graphite electrodes in a diaphragm cell forming a slurry of the hydroxide in the cathode compartment (Chakravarty and Banerjee). Electrolytic recovery of lead and antimony from lead-acid battery wastes was likewise described.

A method of electrolytic extraction of powder zinc from low-grade ores is suggested based on using an alkaline zincate solution. A study of lead oxide in molten slags was presented by T. C. M. Pillay and F. D. Richardson of the Nuffield Research Group of the Imperial College.

A rather novel phase exchange process has been tested in small-scale laboratory for concentrating brannerite from low-grade ores and is essentially a modification of the Trent's "coal-amalgamation" process. In the experimental work the ore was ground with kerosene (plus some oleic acid), then added to water when the brannerite was separated in the kerosene fraction. It was observed that once this mineral had been wetted with water, kerosene did not penetrate the waterfilm. Apparently, large quantities of kerosene are required.

"A New Theory of Ore Sampling" was presented by Pierre M. Gy who presented a mathematical deduction of the error due to discontinuity in the size distribution of values between ore particles and showed that once the error that can be tolerated is known, it is possible to calculate the minimum weight of the total sample required.

**To further the policy of supplying cleaner coal for domestic uses, industry, and for export, the National Coal Board has commissioned The General Electric Co. Ltd. to install a new coal preparation plant at the Board's Aberpergwm Colliery in South Wales. The contract awarded to the G.E.C. is valued at over £650,000. The entire run-of-mine output of the colliery will be mechanically washed at the plant. Daily output will be in the order of 3,500 tons. The plant is expected to be in operation by August, 1960**



*Machinery and Equipment*

# The World's Largest Aerial Survey

Two high-altitude long-range photographic B-17's are now being serviced and overhauled for the Photographic Survey Corporation at Oshawa Airport, near Toronto. They are to play a key role in the Canadian Government's $6,300,000 Arctic Islands aerial survey. This survey starts this spring and is expected to take four to six summer seasons to complete. The B-17's have been fitted by Field Aviation Co. Ltd., a PSC associate, with special equipment, including long-range tanks, to enable them to remain airborne over the Arctic upwards of fifteen hours.

The 500,000 sq. mile project being undertaken by the Federal Government's mapping agency, the Department of Mines and Technical Surveys, is the largest of its kind ever undertaken—and, experts say, the most difficult. The two B-17's (with one held in reserve), the only ones of their type in Canada, are part of a dozen specialized aircraft which will be actively engaged for the next few years photographing the Canadian Arctic Archipelago at a scale suitable for resources development, defence and other purposes.

The B-17's are operated on behalf of PSC by its flying division, Kenting Aviation Ltd. Their assignment is to obtain air photography of 220,000 sq. miles of the eastern section of the Arctic Islands, which includes Baffin Island, Devon Island, and Ellesmere Island. Photographic Survey Corporation bases to be used during the operational season are Frobisher Bay on the south end of Baffin Island; Foxe, which is situated on the Melville Peninsula; Resolute on Cornwallis Island; Alert on northern Ellesmere; and the USAF base at Thule on Greenland. Two other Canadian air survey companies are to photograph the west and central sectors of the Archipelago.

The high-altitude vertical photography obtained by these B-17's is a requisite for reliable base mapping. This photography will also aid hydrographic work in delineating navigable inlets and waters and geological and geographical interpretation. There is considerable interest in the Arctic Islands as a potential source of minerals. A geological reconnaissance of 100,000 sq. miles of the Queen Elizabeth Islands carried out by the Canadian Government in 1955 showed that the Islands contain favourable structures for the accumulation of oil and gas as well as beds of coal and layers of gypsum.

Close proximity of the North Magnetic Pole on Prince of Wales Island renders the standard aircraft compass useless and the more accurate gyro-magnetic compass of little value. The prevalence of sea fog and low stratus cloud during the short operational season is another limiting factor. Aerial photography of the Canadian Arctic Islands will be obtained from a height of 30,000 ft. Survey flight lines are six miles apart.

## NEW CABLE REEL JACK

An extension to their range of Duff-Norton ratchet lowering jacks has been made by the Consolidated Pneumatic Tool Co. with the introduction of a special model for handling cable drums. In construction and operation, the new model follows the main features of the existing range, but includes three specially shaped lugs as hooks for accommodating the drum spindles at heights of 8 in., 16 in., and 24 in. from the ground. Duff-Norton jacks use the familiar lever and fulcrum principle to lift and lower the load. The downward stroke of a lever, acting through a short pawl, raises a hardened steel, square, notched bar or rack by one lift. A long pawl then slips into place to hold the load whilst the lever is being raised to engage a further notch. Controlled ratchet lowering is effected by reversing the mechanism. The advantages of this simple construction, apart from lower cost and maintenance, are faster operation and an easily handled unit.

The cable drum unit, whilst of particular application to straight cable-laying operations, will also meet a need for a simple device in many sections of industry where cable drums of many kinds are handled, such as in the servicing of haulage ropes, hoists, winding gear, and mooring cables. Specifications of the cable reel unit include a weight of 66 lb. and a maximum working load of 5 tons per jack. The hooks will accommodate 2 in. dia. spindles, and the wooden base plate used measures 2 ft. x 9 in. x 2 in. There is complete interchangeability of all internal parts with the 5-ton model in the range for general lifting work.

## MATERIALS HANDLING SYSTEM

On May 29 and 30, at Cresswell Colliery, Derbyshire, a demonstration was held by Berresford Concessions Ltd. to show the Marrel Multi-Container Handling System in operation. The demonstration was attended by engineers and leading officials from many industries where bulk handling of materials is carried out, including the National Coal Board and mining companies.

The unit demonstrated was a Foden standard six-wheel lorry fitted with the Marrel hydraulic handling equipment on a complete deck. The gear, which can be fitted to most standard lorries, was in this case capable of lifting about 10 tons and was demonstrated on colliery slack, timber and electrical cables to show the versatility of the unit. The unit is designed primarily for rapid load shifting over short distances rather than for long-distance haulage.

Berresford Concessions Ltd., who staged the demonstrations, are the northern distributors for the sole concessionaires in this country, Aero Maintenance Equipment Ltd. The manufacturers are Messrs. Bennes-Marrel, Paris. The equipment is well established in France, where many quarries use it, and in certain overseas markets.

In principle, the method derives from fork lifting and pallet handling, and

**Above, the new cable reel jack recently introduced by the C.P. Tool Co. Ltd. Alongside, at left, the Morrel multi-container handling system in operation**

**The latest addition to the fleet of Smith's N.C.B. Electrics operated in the iron ore mines of the United Steel Companies Ltd. This is an explosive carrier based on the 2-ton chassis built at the Gateshead works of Smith's Delivery Vehicles Ltd.**

makes use of standard lorries of various sizes fitted with a hydraulic device for self-loading and self-unloading. It permits of a rapid handling of a variety of containers (skips, buckets, mobile hoppers, etc.). The containers are completely divorced from the truck chassis which carries them. All operations are remote controlled by one man.

The system allows of simultaneous use of several buckets. The trucks are always in circulation, it simplifies loading, and allows for speedy and complete dumping owing to the over 90 deg. angle of the dumper when in the fully unloading position. There are unlimited applications owing to the diversity of loads that can be handled.

## A NEW FLAMEPROOF MOTOR

The introduction of the Monobloc flameproof motor to the present successful range of Worthington-Simpson motorized units will considerably widen the field of application of this type of pumping unit for chemicals, with resultant applications in mine surface installations.

The new Worthington-Simpson range of flameproof totally enclosed, fan-cooled, squirrel-cage induction motors has been designed to meet Groups I and II gases and comply fully with B.S. 229:1957 for flameproof enclosure and B.S. 2613:1957 for electrical performance. The sizes range from 1 h.p. to 7½ h.p., 1,450 r.p.m., and 1½ h.p. to 12½ h.p., 2,900 r.p.m.

In addition to maintaining the principal features of the Monobloc design, the motor enclosure is of substantial construction so as to withstand rough usage and the arduous conditions under which flameproof motors may be called to operate. A prototype machine has passed its Buxton test, and the flameproof certificates which are issued by the Ministry of Power are in the course of preparation.

## SIDE DUMPING BUCKETS

The side dumping bucket for tractor shovels is gaining increasing application throughout the world. Dumping to the side, as well as straight ahead, permits working in tighter spaces and promotes increased production, less ground scuffing, better loading of hauling units, less fatigue to the operator, and lower maintenance costs. Narrow working spaces have always presented problems.

Even when space is not confining, increased production can result from the use of side-dumping attachment. While loading limestone in a quarry, one Caterpillar Traxcavator increased production

39 per cent by changing from the front-dumping method only to the side-dumping bucket. Travel time was reduced 23 per cent, with a total reduction in cycle time of 13 per cent. Elimination of turning reduces ground scuffing to a minimum, a great advantage to miners and quarrymen who cannot tolerate contamination of stone or ore.

In so far as British manufacturers are concerned, the Muir-Hill 2WL loader shown on the stand of E. Boydell and Co. Ltd., at the recent Mechanical Handling Exhibition, featured a new type of bucket which can be tipped either to the front or to one side of the machine, with the capacity remaining at 1 cu. yd. This bucket is presented as being useful for lorry loading or hopper filling.

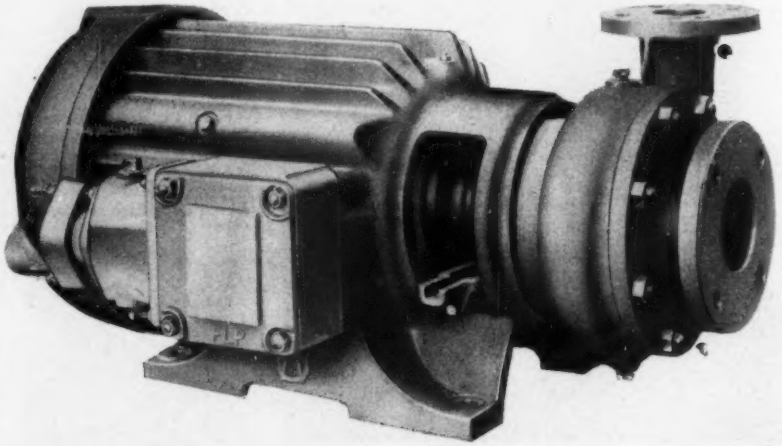
The new bucket is fully interchangeable with the standard buckets in the existing range, and requires the addition of a separate control valve and a three-bank selector in place of the normal two-bank unit. The bucket can be used for normal front-end tipping as well as for side-tipping, and for forward use a pin-type catch is fitted. The simple removal of the pin allows the bucket to be used for side tipping.

## PTFE HYDRAULIC HOSES

The first entirely British-made dispersion polymer PTFE hydraulic hoses are now being marketed, under the trade name Palmer Fluoroflex, by Palmer Aero Products Ltd. Previously obtainable only from dollar sources, they are being made available by Palmer, to users both at home and overseas, with swaged-on or re-usable end fittings.

Hoses of this type are widely used in aircraft, guided missiles, and in many branches of the chemical, engineering, and allied industries, and the Palmer Fluoroflex assemblies, constructed from a new fluorocarbon resin compound with exterior stainless-steel wire braid, will carry a wide range of engineering solvents, hydraulic fluids, acids, and H.T.P., and enjoy a very wide range of chemical, physical, thermal, and electric properties. They are completely unaffected by all chemicals except molten alkali metals and fluorine at elevated temperatures and pressures; operate in pressure ranges from 1,000-10,000 p.s.i.; withstand temperatures from −100 deg. F. to +500 deg. F., are non-ageing, non-flammable, water-repellent, and able to withstand prolonged flexing and vibration.

The new units, designed by the company to supplement its range of well-established Silvoflex hose assemblies, follow closely upon the recent Palmer announcement that it is expanding its product range and design service.



**In centre of page is the Boydell side tipping bucket attachment and alongside, at right, is the new Worthington-Simpson Monobloc flameproof chemical pump**

*Metals and Minerals*

# To Stockpile or Not to Stockpile?

What is sauce for the goose, we are led to believe, is usually sauce for the gander, but evidently this axiom does not necessarily apply to support programmes for depressed metals.

Last week we reported that it was proposed to stockpile 100,000 tons of lead at not less than 13 cents per lb. and 200,000 tons of zinc at not less than 10½ cents. It subsequently transpired, however, that the Administration was having second thoughts on lead and zinc. In preference to stockpiling it proposed higher payments than those put forward under the original subsidy scheme, which had not been well received.

Under the new scheme U.S. producers would be guaranteed a return of 17 cents per lb. on the first 500 tons of lead they sold in each quarter of the year. For zinc they would receive the equivalent of 14½ cents per lb. on a similar tonnage in each three-month period. On sales of lead in excess of 2,000 tons annually, producers would get subsidy payments on an annual production of 350,000 tons to bring their return on that output to 14½ cents. Payments to producers could not exceed 3.375 cents. On sales of zinc in excess of 2,000 tons per year, producers would receive payments on annual output of 550,000 tons to bring their return on that output to 12¼ cents per lb. with payments not to exceed 2.50 cents per lb. Thus large producers would get the higher supports on only a small part of their output.

These proposals should not be taken as necessarily representing the Administration's final decision on lead and zinc, for it is now reported that the United States Senate is considering the addition of a programme for stockpiling lead and zinc to the Administration's measure to support domestic prices of these minerals, and that probably the Administration would not object. (The purchase of 150,000 tons of aluminium has also been proposed.) The Senate plan may call for one year's stockpiling and may raise the support price of both metals by 1 per cent per lb., setting the lead price at 15¼ c. and that of zinc at 13¼ per cent.

In the case of copper, the Administration aims to eliminate the surplus stocks overhanging the market—which it apparently estimates at 150,000 s.tons—by purchasing an equivalent tonnage of United States refined metal at the market price, but not in excess of 27½ cents per lb. The copper would be placed in the supplemental stockpile. Purchases of copper at the present time, it was stated, would not only benefit domestic industry but would also strengthen world market prices and thus benefit foreign producers as well. By inference, the Administration may be assumed to consider the existing lead and zinc surpluses too large to be conveniently removed from the market by similar action.

Meanwhile, it appears to be virtually certain that the copper duty, currently suspended, will be reimposed on July 1, as must automatically happen unless Congress acts otherwise. It would be 1.7 c. per lb. when the price is 24 c. or more, and 2 c. per lb. below 24 c.

The various schemes and amendments for price stabilization which have been put forward in recent weeks point to the difficulties which the United States Government is experiencing in its search for a means to assist domestic producers without upsetting United States economic relations with the raw material producing countries. Possibly, the government's approach to the problem has also been influenced by the President's desire to achieve commodity stabilization before the U.N. Study Conference in September, as well as by the need to have an extension of the Reciprocal Trade Programme for another five years without the addition of crippling import restrictions.

It remains to find ways and means of financing the copper stockpile (and possibly lead and zinc stockpiles), as well as the five-year subsidy programme for lead, zinc, tungsten, and acid-grade fluorspar. Senator James Murray, chairman of the Senate Interior Committee, anticipates that the copper stockpile legislation is likely to pass the Senate about July 1 and the House about mid-July. Without a national security justification for additional stockpiling, however, there may well be a tough battle, especially in the House, to get the necessary funds.

## CANADA'S FIRST THORIUM PLANT

Plans for construction of the first Canadian thorium plant have been announced by Rio Tinto Dow Ltd. The Hon. R. H. Winters, president of the Rio Tinto Mining Co. of Canada Ltd., reported that a construction contract had been awarded to Humphreys and Glasgow (Canada) Ltd., and that work would start immediately. The plant will produce crude thorium concentrates and refined metallurgical-grade thorium sulphate and thorium oxide. It is expected that plant operations will be under way by January, 1959, capacity production being attained in May of the same year.

Humphreys and Glasgow will be responsible for the design, engineering and construction of the plant itself and for the installation of the special equipment and machinery required. The value of the project has not been disclosed, but it has been publicly estimated to exceed $1,000,000.

The formation of Rio Tinto Dow Ltd. was announced early this year in a joint statement by the Rio Tinto Mining Co. of Canada Ltd. and Dow Chemical of Canada Ltd. The company was formed to produce thorium and rare earths from by-product materials of uranium mining operations in the Blind River-Algoma area.

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A factory in Sheffield, managed by Thos. Firth and John Brown Ltd., which for eight years has been making metallic thorium, is to close before the end of 1958. The Atomic Energy Authority is now able to carry out manufacture of the fuel itself.

## SCHEELITE PRODUCERS HIT

King Island Scheelite (1947) Ltd. will cease mining operations for the present. Its mine in Tasmania is to be placed on a care-and-maintenance basis from August 2. The decision has been forced on the company by the continued fall in the price of tungsten and an uncertain outlook for the near future.

From Rhodesia comes a report that, unless there is a substantial recovery in world market prices, the country's remaining scheelite producers may be forced to close down at the end of this year. There are now only three significant producers still mining scheelite in Southern Rhodesia (a fourth operator produces only very minor quantities). Those still in production are only able to continue mining because of long-term contracts arranged some time ago at prices well above current market levels. At the height of the tungsten boom during the Korean war, there were some 150 producing units.

The grade of Rhodesian ores varies between 69 per cent and above 70 per cent $WO_3$, but the deposits are small and patchy and therefore cannot be worked on the scale needed to bring costs down significantly. For operations to be continued economically into 1959, a world price in the region of 150s. per l.ton unit would be necessary. Producers in Portugal, Spain, and the Far East can operate profitably on a price far lower than the Rhodesian industry requires.

In London the wolfram ore shipment market has lost further ground. Prices are now indicated at 73s. to 75s. per l.ton unit c.i.f. Europe for minimum 65 per cent material. Buying interest remains scant. Moreover, unsold tonnages of ore are still reported to be available in Europe, while Russian material is also understood to be on offer at under currently quoted levels. In these circumstances even the present price structure cannot be regarded as very secure.

The market will, of course, right itself in time under the combined influence of recovering demand from the steel industry and reduction of output as more and more mines are forced to shut down. How soon the recovery will take place and at what point prices will touch bottom remains anybody's guess.

## JAPANESE HAFNIUM?

The Toyo Zirconium Co., of Japan, which has been negotiating with the Commodity Credit Corporation for export of 1,000 tons of zirconium to the U.S. on a long-term basis, has revealed failure to reach agreement. Toyo recently completed construction of a 30-ton a day plant at Toda, Saitama. The firm concluded a contract with the U.S. last year for 200 tons of zirconium and its last delivery is scheduled for June, 1958. Now Toyo is making preparations to

switch its production from zirconium to hafnium, for which the U.S. may invite a tender in the near future.

### JAPANESE NICKEL PROBLEM

The Nippon Mining Co.—a leading nickel refinery in Japan—has suggested that local nickel producers suspend production of both metal and ferro-nickel for six months to tide over the current recession on the Japanese nickel market. Leaders of the industry are to discuss the problem at an emergency conference. The company said nickel production in Japan had already been curtailed by between 40 and 60 per cent because exports of both these items, which account for half the production, had dropped sharply, especially to European markets. Japanese nickel refineries had hoped to gain a new export market in mainland China, but their hope was shattered by the recent rupture of trade relations.

The refineries have been withholding purchases of nickel ore from New Caledonia—Japan's sole supplier—in view of the increase in stocks and dwidling exports. To cope with the situation, producers have made every effort to seek lower prices of nickel ore and succeeded in concluding contracts with New Caledonian shippers to buy nearly 20,000 tons at 48 c. per lb. f.o.b. New Caledonia for 3.2 per cent ore. However, these contracts were held up by the New Caledonian Government, which did not approve them because of the low price. The nickel refining industry has therefore started top-level discussions on the import of ore, and the Japanese Mining Association is to send a mission to New Caledonia for direct negotiations with the government and shippers.

## COPPER · TIN · LEAD · ZINC

*(From Our London Metal Exchange Correspondent)*

Although prices generally have eased during the past week the undertone of all markets can still be described as satisfactory. Trading has been quieter than recently but at the same time a fair volume of business has been going through the Exchange.

### CONFUSING COPPER SITUATION

Copper values tended easier at the end of last week and early this week three months' metal was traded down to £192 10s. This was only a temporary reaction which encouraged some interest, mainly on Continental account, and values quickly recovered during the same market. On paper a fall of this nature from the high of £207 10s. reached during the recent upward movement appears appreciable, but it must be emphasized that the decline was gradual and good buying resistance was encountered all the way down. Behind the fall in London lies the 1 c. reduction in the customs smelter price early in the week to 25½ c. as consumer demand at the higher level was apparently very slow. At the time of the increase, barely a week earlier, it was understood that the satisfactory state of smelters' order books justified their action. It is, therefore, all the more confusing when unsatisfactory demand within a short period necessitates a price cut of fully 1 c.

As far as producers are concerned, the fact that Kennecott and Phelps-Dodge continue to quote 25 c. and have not seen fit to follow the rise initiated by Anaconda to 26½ c. was regarded as "bearish". It remains to be seen whether the higher level can be held in the face of only mediocre demand and the fact that the companies' fabricating subsidiaries who initially followed the rise were by the end of last week once again selling their products on the basis of 25 c. in line with the other major fabricators.

There has been no further news concerning the U.S. Government proposal to stockpile 150,000 tons of American produced copper or in connection with the copper duty. In view of the shortage of time between now and the end of the month, it seems likely on balance that the suspension will lapse and from July 1 the duty will be re-imposed at 1.7 c. with the price above 24 c. Some quarters express the opinion that this re-imposition of the duty will possibly be of a temporary nature and as soon as the stockpiling gets under way, it will be suspended again. Scrap copper in the U.S. after a rise of ¼ c. earlier in the week was later reduced this amount and is now quoted 21 c. for No. 2 Wire. Meanwhile, figures published by the Bureau of Mines shows consumption of copper scrap for April to be 12 per cent higher than March at 83,300 tons.

Latest reports from Santiago indicate that efforts are still being made to reach a settlement in the El Teniente wage negotiations. A vote for or against strike action is due to be taken on June 30 in the absence of a settlement. Stocks in U.K. official warehouses at the end of last week further declined 725 tons to 14,157.

### I.T.C. APPROACHES RUSSIA

With consumer demand quiet, tin values have shown little change during the past week. The main result, announced in a communiqué issued at the close of the International Tin Council meeting in Paris at the end of last week, is the decision "formally" to invite the Soviet Union to become a producer/participant in the Agreement. It is generally agreed that there is little incentive for Russia to join the scheme, as it would obviously entail limiting her exports of metals, now estimated at about 12,000 tons per year, and also giving information regarding production and consumption which she might not wish to do. It remains to be seen in due course how they reply to this invitation, but it seems unlikely to be favourable. The next meeting of the Council has been arranged for July 22 in London when export quotas for the producer countries will be fixed for the period October 1/December 31, 1958.

Tin consumption in the U.S. increased 3 per cent in April to 6,105 l.tons against March at 5,920 l.tons. Stocks of tin in official warehouses declined 91 tons at the end of last week to 19,010.

On Thursday morning the Eastern price was equivalent to £754¾ per ton c.i.f. Europe.

### NEW PROPOSALS FOR LEAD-ZINC SUPPORT

The lead and zinc markets have been subjected to a variety of proposals and counter-proposals in the way of plans for the support of these metals in the United States. The President has delayed any action on the tariff commission recommendations for increases in duties on these metals pending an alternative being found. Last week we mentioned a possible stockpiling programme, but within a few days another suggestion put forward in Washington by the Secretary of the Interior covered higher government payments to United States producers of lead and zinc. In the case of lead, they would be guaranteed 17 c. per lb. on the first 500 tons sold in each quarter, and on sales in excess of 2,000 tons annually a subsidy payment on a production of 350,000 tons would give them 14¾ c. with a maximum payment of 3.375 c. Comparative figures for zinc would be 14½ c. on the first 500 tons and on an annual output of 550,000 tons 12¼ c. with a maximum payment of 2½ c.

No sooner had the market had time to digest this, however, than another stockpiling as opposed to the subsidizing programme was announced. This incorporates certain points common to both the previous suggestions, namely: the tonnage of lead is 100,000 tons at 14¾ c. and 200,000 tons of zinc at 12¾ c. This has been placed before a Senate Committee and although initially it might be well received, it will be another matter to obtain final acceptance of the scheme by the House of Representatives.

For the month of April, United States mines produced 25,700 tons of recoverable lead compared to 18,300 tons in March, and comparative figures for zinc were 38,700 and 35,624. The U.S. Smelting, Refining and Mining Co. has closed one of its lead smelters on account of lack of sufficient smelting ore and concentrates.

Meanwhile demand for lead in the United States at the higher price of 11½ c. has quietened, and it would appear that the maintenance of this price is rather on a day-to-day basis. Demand for zinc is relatively quiet, and in certain cases a shading of premiums on high-grade metal has taken place. During the week the British Government announced that they would not be disposing of any more of their lead for the time being, and that between January and June they had sold 6,700 tons.

Closing prices are as follows:

| | June 19 | | June 26 | |
|---|---|---|---|---|
| | *Buyers* | *Sellers* | *Buyers* | *Sellers* |
| COPPER | | | | |
| Cash .. .. | £203¾ | £204 | £199 | £199¼ |
| Three months .. | £204¼ | £204½ | £199¼ | £199½ |
| Settlement .. | £204 | | £199¼ | |
| Week's turnover | 13,450 tons | | 9,750 tons | |
| LEAD | | | | |
| Current ½ month | £77¾ | £78¼ | £75 | £75¼ |
| Three months .. | £79 | £79¼ | £76 | £76¼ |
| Week's turnover | 8,875 tons | | 3,675 tons | |
| TIN | | | | |
| Cash .. .. | £730¼ | £731 | £730 | £730½ |
| Three months .. | £733½ | £734 | £733 | £734 |
| Settlement .. | £731 | | £730½ | |
| Week's turnover | 1,880 tons | | 1,220 tons | |
| ZINC | | | | |
| Current ½ month | £66 | £66¼ | £65¼ | £65½ |
| Three months .. | £66¾ | £67 | £66¼ | £66½ |
| Week's turnover | 10,575 tons | | 5,350 tons | |

**London Metal and Ore Prices appear on page 762.**

*Mining Finance*

# Loraine Cuts Her Losses

The proposed merger of Loraine and Riebeeck, the two northernmost properties in the O.F.S., appears to be of advantage to all concerned. No doubt Loraine shareholders must feel some disappointment at what is, in effect, an admission of the mine's failure. The level of Loraine shares over the past few years, however, is clear indication that most investors had already written the mine off, even as a speculation. Even if Loraine had begun to show signs of increasing profitability, dividends would have been an extremely distant prospect, so heavily indebted is the mine. For Riebeeck holders the deal is, of course, most attractive.

The main proposals are as follows: Loraine's overheavy capitalization will be written down and consolidated to consist of £1,645,337 in 10s. shares. The note capital, of just over £500,000, will remain unchanged, but Anglo American will waive about £711,000 of its loan to Loraine, leaving it at about £3,446,000, to be funded over a long period (£1,850,000 of this debt would otherwise have been repayable next week). A quarter of the Anglo loan will be convertible at a later date, but until such conversion is effected, Loraine's indebtedness will amount to just under £4,000,000. Meanwhile, Loraine will offer to purchase the Riebeeck property for 9,000,000 Loraine shares, to be offered to Riebeeck holders in the proportion of nine Loraine for seven Riebeeck. The merger effected, Anglo will lend the new company £1,000,000, interest free until one year after the commencement of production on the No. 1 shaft area of Riebeeck, while the other £3,000,000 needed to bring this area and the southern part of Loraine to production will be met by a rights issue.

Thus if the proposals are carried through, the new company's capital structure will be: £6,145,337 in 10s. shares, £546,628 6 per cent unsecured notes, and £4,993,000 loans from Anglo American and others. The further share capital to be raised by way of rights, and possibly by way of loan conversion, will, of course, depend on the price at which the issue can be made.

The objects of the merger are twofold: to provide the promising Riebeeck mine with reduction plant and shaft facilities earlier and at less cost than would otherwise have been possible; and to cut what was beginning to look like a heavy loss on the Loraine operation. From each company's point of view the move is thus advantageous, and, a point of no little importance, the reorganized company will have the benefit of an extremely large assessed loss (perhaps £20,000,000 initially) to set against taxation. This may well be the reason why, in name at any rate, Loraine is to take over Riebeeck and not vice versa.

The technical problems which will arise will be considerable. The "Rainbow" reef structure at Riebeeck is unique among Rand mines in that the gold-bearing formations are more in the nature of an orebody than of the usual reef. Loraine, on the other hand, is a normal operation on the "A", "B", and Basal/Leader reefs, apart from a small area in the north-west corner underlain by Rainbow reefs. Again, ore will have to be moved over substantial distances, while at the same time tramming from Loraine to Riebeeck means either driving further haulages through long stretches of country rock, or perhaps a subvertical shaft near the present boundary. Nevertheless, these problems are by no means insuperable. In any case, Anglovaal (who will manage the reorganized mine) have on many previous occasions met novel problems with novel solutions.

There remain two untidy ends to be tied up. It is well known that Loraine has been having difficulty in filling its allocation at the O.F.S. joint uranium plants. Riebeeck, on the other hand, is not a scheduled uranium producer, although local opinion seems to be that the "U" values on the property are above average. This being so (and it must be remembered that much the same sort of thing was being said about Loraine three years ago), some indication would be welcome as to whether the new mine will take over the Loraine contract or whether a new one will have to be negotiated.

The peculiar limitations of Riebeeck's mining lease also seem likely to present a problem. The company, it will be remembered, is entitled to mine the upper (Rainbow) reefs only, unless it turns out to be impossible to prove a "satisfactory mine". Were this to be the case, the company would be permitted to mine the "A", "B", and Basal reefs, the rights on which otherwise remain vested in General Mining. In the original Riebeeck drilling programme values up to 3,131 in. dwt. were exposed on these lower reefs, although the general level of values was much lower (deflections in this same borehole, for example, reached no more than 94 in. dwt.). With workings on these reefs already developed on the Loraine property, it would be surprising if negotiations are not initiated with a view to giving the reorganized mine rights on them.

## LONDON TIN: IMMEDIATE OUTLOOK CLOUDY

Considering the difficulties that tin producers have had to face over the last eighteen months, London Tin's results for the year to March 31 last are by no means unsatisfactory. It must be remembered, however, that due to a change in the Corporation's accounting date, the year's results are below compared to an eleven month period. Net profit of the Corporation itself amounted to £1,330,768, barely changed from the previous eleven months, while the inclusion of profits from subsidiary companies brought the total to £1,390,852, a matter of £13,000 less than in 1957. Taxation absorbed £704,756 against £732,933, and from the balance of £686,096 unchanged dividends of 30 per cent were declared, costing £624,146.

The comparatively small drop in total earnings is, of course, a result of the time-lag effect inherent in London's Tin accounts. A quite considerable proportion of the Corporation's income in the 1957-8 financial year was derived from dividends declared out of profits made in the relatively prosperous second half of 1956 and first half of 1957. Similarly, although tin quota restrictions were operative during the last three months of the financial year, their effect on the present accounts must have been more or less negligible.

This time-lag, of course, works both ways. The Corporation's accounts for the current year will reflect a tin price bumping on the £730 floor, lower production as a result of the quota restrictions, and the drain on the operating companies' earnings caused by the calling-up in quick succession of various buffer stock contributions. Obviously, therefore, some reduction in the current year's dividend must be anticipated, although as Mr. J. Ivan Spens, the chairman, says in his circulated statement, it is too early to say how severe this will be.

Unfortunately, on the subject of profits tax, Mr. Spens was not able to add to what is already known. London Tin, it will be remembered, is one of the investment companies whose distributable income is adversely affected by the O.T.C. provisions of the 1957 Financial Bill. The 1958 budget proposals for a flat-rate profits tax will alleviate the additional liability to some extent, but there is as yet no provision for restoring the relief that such companies previously enjoyed. It seems certain that this side-effect of the O.T.C. legislation was unintentional, and in January the British Overseas Mining Association took the matter up with the authorities. No results have yet been forthcoming, but representations are continuing during the passage through Parliament of the 1958 Finance Bill.

Mr. Spens' statement is on page 763.

## ZAMS, TANKS AND THE RAILWAY

Another company whose results are substantially distorted by a time-lag is Zambesia Exploring, one of a closely inter-related group of companies including the Rhodesia-Katanga Co., Tanganyika Concessions, Kentan Gold, and the Benguela Railway Co.

The time-lag in Zam's accounts is a double one, in that Zam's largest source of income is its large investment in Tanganyika Concessions, whose financial year ends on July 31, as opposed to March 31 in the case of Zams. Tanganyika Concessions in turn derives income almost exclusively from the Union Minière du Haut Katanga, and from the Benguela Railway Co., both of which close their books on December 31. Thus, it happens that Zam's profits for the year to March 31, 1958, are largely derived from the earnings of these two latter companies for the year ended December, 1956, a year in which Union Minière broke records with regard both to output and profits.

Zam's profits in the 1957-8 fiscal year are, therefore, only of passing interest, and the improvement from £24,320 to £29,698 no more than could reasonably be expected. Union Minière's 1957 divi-

dends, however, were reduced by roughly one-third, so that next year's profits would be a different story were it not for the Benguela Railway, a 90 per cent subsidiary of Tanks. Railway receipts during 1957 were somewhat down on the 1956 figure, but the company has been able to double its 1956 distribution to 33 Esc. per share.

Tanks' net cash income from this will be substantially unchanged, as Benguela has ceased its previous practice of prematurely redeeming its debentures, all of which are held by the parent company. Nevertheless, the increased dividend will provide a substantial offset against the reduced Union Minière dividends, since Tank's will now be able to take the whole of the Benguela income through the profit and loss acount, where previously a portion of it went direct to the balance sheet. Thus, the near-term outlook for Zams need not be so bleak as might appear.

### THE NEW PIONEER TAKE-OVER TALK

Widespread discussion has been heard this week regarding the possibility that the New Pioneer Co., one of the holding companies within the General Mining group, might be taken over by the parent company.

On grounds of rationalization alone, such a move would not be surprising. Within the General Mining group there are three major holding companies—New Pioneer, East Rand Extensions and Southern Van Ryn—who, between them, own investments to the market value of about £5,000,000, almost entirely in the three Lucas Block mines. There would be obvious advantages in bringing these holdings together and if the current rumours prove true, further steps in the same direction may well be taken—a merger of East Rand Extensions and Southern Van Ryn, possibly, or a further take-over.

Of the three finance companies mentioned above, New Pioneer is by far the largest. At June 30 last year the market value of its investments totalled over £2,600,000, equivalent to some 26s. 4d. per share. With no indication of how the portfolio is divided between Harties, Buffels and Stils, it is impossible to estimate accurately the extent of the appreciation over the past twelve months, but taking a conservative view (and adding in other assets, including the Stilfontein Township) £4,000,000 is a reasonable guess of the present value of the company on an asset basis, equivalent to 40s. per share.

Thus, even if the present take-over talk is ill-founded, the current price of around 37s. 9d. is by no means excessive. On the last dividend of 2s. 6d. they yield over 6½ per cent gross, and, of course, the prospects for a substantial increase in this dividend next year are extremely good.

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**O.T.C. Savings Help Tanjong.**—Gross profits of Tanjong Tin Dredging were sharply reduced from £444,157 in 1956 to £287,846 last year. The tax charge of £119,000, however, was less than half of the previous year's figure, leaving net taxed profit only fractionally lower at £140,340. From this, dividends totalling 6s. 6d. per share were declared, against ordinary dividends of 7s. 6d. and capital dividends of 8s. last year. The liquid position remains healthy, with net quick assets at over £300,000. Meeting, London, July 10. Mr. A. G. Glenister is chairman.

## LONDON METAL AND ORE PRICES, JUNE 26, 1958

### METAL PRICES

Aluminium, 99.5%, £180 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Crude (70%) £190 per ton
Ore (60%) bases 19s. 6d./20s. 6d. nom. per unit, c.i.f.

Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 0d. lb.
Cerium (99% net), £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 7s. 2d. lb.
Cobalt, 16s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 8d. per gram
Gold, 250s. 4d.
Iridium, £22 oz. nom.
Lanthanum (98/99%) 15s. per gram.
Manganese Metal (96% - 98%) £310
Magnesium, 2s. 5½d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18 oz. nom.
Osmiridium, nom.
Palladium, £6 5s./£6 15s.
Platinum U.K. and Empire Refined £24/£25 oz.
Imported £20 10s./£21 10s.
Quicksilver, £76 10s. ex-warehouse nom.
Rhodium, £40/£42 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 75d. f. oz. spot and 74½d. f'd.
Tellurium, 14s./15s. lb.

### ORES AND OXIDES

| | |
|---|---|
| Bismuth | 30% 5s. 0d. lb. c.i.f.<br>20% 3s. 3d. lb. c.i.f. |
| Chrome Ore— (Fe ratio 3 : 1) | |
| Rhodesian Metallurgical (semifriable) 48% | £16 5s. 0d. per ton c.i.f. |
| ,, Hard Lumpy 45% | £16 0s. 0d. per ton c.i.f. |
| ,, Refractory 40% | £11 10s. 0d. per ton c.i.f. |
| ,, Smalls 44% | £14 10s. 0d. per ton c.i.f. |
| Baluchistan 48% | £11 15s. 0d. per ton f.o.b. |
| Columbite, 65% combined oxides, high grade | nom. |
| Fluorspar— | |
| Acid Grade, Flotated Material | £22 13s. 3d. per ton ex. works |
| Metallurgical (75/80% $CaF_2$) | 156s. 0d. ex works |
| Lithium Ore— | |
| Petalite min. 3½% $Li_2O$ | 47s. 6d./52s. 6d. per unit f.o.b. Beira |
| Lepidolite min. 3½% $Li_2O$ | 47s. 6d./52s. 6d. per unit f.o.b. Beira |
| Amblygonite basis 7% $Li_2O$ | £26 5s. per ton f.o.b. Beira |
| Magnesite, ground calcined | £28 0s./£30 0s. d/d |
| Magnesite Raw (ground) | £21 0s./£22 0s. d/d |
| Manganese Ore Indian— | |
| Europe (46% - 48%) basis 67s. 6d. freight | nom. |
| Manganese Ore (43% - 45%) | nom. |
| Manganese Ore (38% - 40%) | nom. |
| Molybdenite (85% basis) | 8s. 5d. per lb. (f.o.b.) |
| Titanium Ore— | |
| Rutile 95/97% $TiO_2$ (prompt delivery) | £35/£36 per ton c.i.f. Aust'n. |
| Ilmenite 52/54% $TiO_2$ | £11 10s. per ton c.i.f. Malayan |
| Wolfram and Scheelite (65%) | 73s. 0d./75s. 0d. per unit c.i.f. |
| Vanadium— | |
| Fused oxide 90 - 95% $V_2O_5$ | £10 per unit c.i.f. |
| ircon Sand (Australian) (65 - 66% $ZrO_2$) | £14 5s. per ton c.i.f. |

## MARKET HIGHLIGHTS

One of the main talking points in the mining section of the Stock Exchange during the past week was the sharp reversal in what had been previously a strong copper share market. Signs of a break in the revival had already been signalled by the failure of the other major U.S. copper producers to follow the increased 26½ c. quotation announced by Anaconda. Subsequently, the customs smelters retreated from their recently increased price with a general cut of 1 c. to 25½ c. In London, cash copper fell to little above £192 a ton from its earlier £200 plus and share prices swiftly followed the trend.

In the general setback, Nchanga and Messina issues were notably weakened. Nchanga fell from 10 7/16 to 9⅞ and Messina came back 10s. to 88s. 9d., the options falling a similar amount to 55s.

At the time of writing nobody quite knows which direction the next move will take. There is a fairly general feeling that there is money to be made in copper shares, but with so many imponderables in the near outlook for the metal price a potential investor must be prepared to face short-term losses. The share market generally remains highly sensitive and for the present is probably best left severely alone.

Even so, the longer-term outlook for copper is good and investors are bound to be tempted by the occasional boomlets that crop up in the share market from time to time. The answer to the problem seems to be provided by M.T.D. Mangula. The shares of this new producer were issued last year at their par value price of 5s. when copper was at its depressed levels of £160-£170. A steady investment demand has since raised them to 6s. 9d. at which price they still offer attractive investment possibilities. They also have the advantage that unlike the higher priced Rhodesian producers, they are less prone to price fluctuations.

Other base-metal share markets moved rather indeterminately during the past week. Lead-zincs fell away for most of the time but later rallied in recognition of the firmer metal quotations. Tins behaved quite well, but drew little comfort from the metal price and the Tin Council meetings which were held in Paris.

Little excitement but a solidly firm undertone characterized the gold share market. A flurry of interest was aroused by the proposed Loraine - Riebeeck merger; the respective shares spurted to 3s. and 15s. 6d. before profit-taking quickly reduced the gains. Also good were New Pioneer which reached a new peak of 37s. 9d. on continued talk of a possible take-over move by General Mining. Free State Saaiplaas came in for Cape support on the theory that the Basal Reef had been intersected by the No. 1 shaft and Free State Geduld (88s. 1¼d.) reflected the growing demand for shares of the younger gold producers. Otherwise, shares of the older mines were left very much to themselves and among finance houses a steady demand was noted for Union Corporation.

Elsewhere, the not very encouraging course of Wall Street tended to subdue interest in the Diamond section. It did worse in the case of platinum shares which completely lost their previous upturn as continued offerings were received from the Cape.

# LONDON TIN CORPORATION

## CHAIRMAN'S STATEMENT

The 32nd Annual General Meeting of London Tin Corporation Limited will be held on July 15 at The Chartered Insurance Institute, 20 Aldermanbury, London, E.C.

The following is the statement by the Chairman, **Mr. J. Ivan Spens, O.B.E.,** which has been circulated with the report and accounts for the year ended March 31, 1958:

### Accounts

The net profit for the year, after providing for taxation, was £644,768, which compares with £714,726 for the eleven months ended on March 31, 1957.

The dividends totalling 30 per cent., less Income Tax at 8s. 6d. in the £, already paid in respect of the year took £624,146 and left a balance for the year of £20,622 to be added to the carry forward, which now stands at £310,212.

Although the gross income from investments was a little lower than for the previous period the important item in the Accounts is taxation which this year takes £686,000 (after allowing for £75,000 no longer required in respect of previous years) and compares with a total of £652,000 for the previous period. This increase is due in the main to the incidence of the Finance Act, 1957, whereby a part of our income from Overseas Trade Corporations had to bear the Profits Tax of which it was formerly relieved. The flat rate of Profits Tax proposed in the Finance Bill, 1958, will mitigate this situation in the current year so far as the actual tax liability is concerned but the Bill still makes no provision to restore relief from Profits Tax in respect of income from investments in Overseas Trade Corporations. Shareholders were informed during the year that the Finance Act, 1957, would adversely affect the distributable profits of this Corporation and that representations were being made to the Revenue Authorities. The matter is now being taken up during the passage through Parliament of the Finance Bill, 1958.

### Control of Tin Exports

Control of exports of tin from the six countries contributory to the International Tin Agreement was introduced by the International Tin Council with effect from December 15, 1957, and has since been extended to September 30, 1958. Meantime, the Council will decide what measure of control beyond that date is necessary.

Since December 15, 1957, the overall cut-back in production for export has been approximately at the rate of 40 per cent. per annum based on the total production of the contributory countries for the twelve months ended September 30, 1957, but the actual rate applicable in each individual country varies.

### Price of Tin

The average London cash price of tin metal during the year under review was £743 per ton. The highest price reached was £782 per ton and the lowest £730 per ton which is the Buffer Stock floor price. The International Tin Council has authorized the Buffer Stock Manager to operate, should opportunity offer, within the middle price range of £780 to £830 per ton until September 30, 1958. This authority, however, is subject to review by the Council at its regular Meetings.

### Malaya

Malaya achieved independence at the end of August, 1957, and the sympathetic consideration and good will of Government previously enjoyed by the tin mining industry continues under the new Constitution.

At the close of the year under review there were thirty-six dredges in Malaya under the management of Anglo-Oriental (Malaya) Limited. Of these twenty-seven were in operation, one was being re-constructed and eight were idle. The idle dredges included three closed down because of export control, two scheduled to be dismantled and sold, and one hitherto idle for security reasons which can be overhauled and recommissioned when convenient. The other two will be kept for the present in case any suitable shallow areas become available for them to work. Every opportunity of further prospecting continues to be taken as the security situation improves.

The total output of tin concentrate from the mines managed by Anglo-Oriental (Malaya) Limited during the year under review was 13,740 tons which compares with 16,346 tons in the previous twelve months. The greater part of this output was exported during the year but the balance was produced for permitted stock after the inception of export control in order to keep the dredges as far as possible in continuous production.

### Thailand

The output of tin concentrate from the mines under the management of Anglo-Oriental (Malaya) Limited in Thailand during the year under review was 1,413 tons compared with 1,762 tons in the previous twelve months. This fall was due, in the main, to the low rate of quota allocated to dredges by the Thai authorities during the first quota period to March 31, 1958.

### Burma

The general conditions in Burma are unfavourable to mining although the security position has to some extent improved. The two small dredges which I reported last year to be on trial have since been brought into production but their output is small and probably it will not be possible to maintain them in continuous and economic operation.

### Nigeria

The mines under the management of A. O. Nigeria Limited produced 4,397 tons of tin concentrate and 576 tons of columbite which compares with 4,529 and 758 tons respectively for the previous twelve months. The mining of primary columbite having been suspended during the previous year because of the poor demand for the product, the output for the year under review arose entirely from the treatment of tin-bearing alluvial. This, together with the enforced cut-back in tin production, necessitated a considerable retrenchment of Staff which is much regretted. Prospecting and research, however, are both being actively continued.

### Directors

It is with deep regret we record the death of Mr. Richmond Temple on March 13, 1958. He had devoted his energies to the affairs of this Corporation and of the tin mining industry for a long period of years and we remember him with esteem and with gratitude for his work.

Mr. J. L. Farrington who is Chairman and General Manager of A. O. Nigeria Limited, and is at present in Nigeria, was recently appointed to the Board. In accordance with the Articles of Association he retires at the Annual General Meeting and offers himself for re-election.

### General

During the year under review Lord Colyton accompanied me to Malaya and Nigeria where we were able to visit mines under our management and to have discussions with the Directors of our management Companies. The objects of major importance to the tin mining industry in both these spheres are, on the one hand, intensive prospecting to endeavour to find fresh ore reserves, and, on the other, research to improve the methods of mining and the processes to make possible the profitable exploitation of ore deposits which may be found at greater depth. The work is costly and much of it can prove abortive but it is imperative to provide for the future, and Governments can and should assist by a liberal policy of alienation of land for mining. Our managements are alert to these important objectives and will continue to pursue them. I am pleased to record the impression we gained of the efficiency of our organization in each of these countries and the loyalty and energy of Chinese, Malayan, Indian and African senior staff and employees.

The prospects for the current year must be influenced by the price of tin and the rate of cut-back in production. If both these factors continue throughout the year at their present levels our income from our large portfolio of tin mining shares will certainly be much lower than last year. It is unfortunately impossible at this early stage to indicate to what extent the Corporation's dividend for the year will eventually be affected although some reduction is probably inevitable.

THE PROPRIETORS of Patent No. 709142 for "Improvements in or relating to Electric Detonators for Blasting and Like Purposes" desire to secure commercial exploitation by Licence in the United Kingdom. Replies to Haseltine Lake & Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2.

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## KADUNA SYNDICATE

The 47th Ordinary General Meeting of the Kaduna Syndicate Limited was held on June 25 in London, **Mr. Hector R. Mackilligin, M.Inst.M.M.** (the chairman), presiding.

The following is an extract from his circulated statement:

The production of tin concentrate of shipping grade in the year ended December 31, 1957, was 321 tons, compared with an output of 304 tons in 1956. The average grade of ground worked during the year was 0.67 lb. per cubic yard compared with 0.77 lb. in 1956. As a result, despite the larger output, the cost per ton delivered f.o.r. was only slightly lower at £257 8s. 8d. as compared with £258 15s. 10d. in the previous year.

Application was made for the Company to be granted status as an Overseas Trade Corporation. Provisional status was granted to the Company as from December 1, 1957, and it is considered extremely improbable that this will not be confirmed.

Mining profit for the year after various charges was £44,735 as compared with £43,621 in the previous year. The Directors recommend a final dividend of 58½ per cent, less income tax, making 75 per cent for the year.

Shipments of tin ore are drastically curtailed under the International Tin Agreement, and it is expected that the Company's permitted shipments for the nine months to September 30, 1958, will be approximately 120 tons. Shareholders may rest assured that everything possible is being done to reduce expenditure whilst at the same time retaining as far as possible our resident labour force.

The report was adopted.

## KADUNA PROSPECTORS

The 43rd Ordinary General Meeting of Kaduna Prospectors Limited was held on June 25 in London, **Mr. Hector R. Mackilligin, M.Inst.M.M.** (the chairman), presiding. The following is an extract from his circulated review:

The production of tin concentrate of shipping grade for the year ended December 31, 1957, was 86 tons, which compared with an output of 71 tons in 1956. The average grade of ground worked, at 0.63 lb. per cubic yard, was higher than for some years, and this, coupled with the increased output, resulted in a reduction in the cost per ton delivered f.o.r. from £328 13s. 9d. to £288 5s. 4d.

Application was made for the Company to be granted status as an Overseas Trade Corporation. Provisional status was granted as from December 1, 1957, and it is considered extremely improbable that this will not be confirmed.

Mining profit for the year after various charges was £10,187 as compared with £3,960 in the previous year. The Directors recommend a final dividend of 33⅓ per cent, less income tax, making 41⅔ per cent (10d. per share) for the year.

Shipments of tin concentrate are drastically curtailed under the International Tin Agreement, and it is expected that the Company's permitted shipments for the nine months to September 30, 1958, will be approximately 30 tons.

Shareholders may rest assured that everything possible is being done to reduce expenditure whilst at the same time retaining as far as possible our resident labour force.

The report was adopted.

## Publications Received

The production of iron ore in Sweden rose in 1957 at a considerably lower rate than in 1956 and 1955, reports *Economic Survey, 1957*, published by Svenska Handelsbanken. This was due to the changeover from opencast to underground mining on the Lapland orefields. Marketing conditions remained favourable. The volume of production was slightly over 20,000,000 tonnes, or 5 per cent more than in 1956. As usual, nearly 90 per cent was exported. Exports at 17,500,000 tonnes were fractionally higher than in 1956. The continued changeover in production to underground mining gives cause for the belief that no marked increase in either production or exports can be expected in 1958. Furthermore, marketing prospects may be affected by the deterioration in the iron and steel trade.

★

A thousand technical and economic reports, journal articles, and other publications describing Bureau of Mines research and development work on coal and its products are listed in a new bibliography issued by the U.S. Department of the Interior (Bureau of Mines Information Circular 7825), "Bibliography of Bureau of Mines Investigations of Coal and its Products, 1950 to 1955", by E. P. Carman and Frances S. Bayes.

★

A new map showing test wells for oil and gas, oil and gas fields, and pipelines in Nebraska has been published by the United States Geological Survey in co-operation with the Nebraska Geological Survey.

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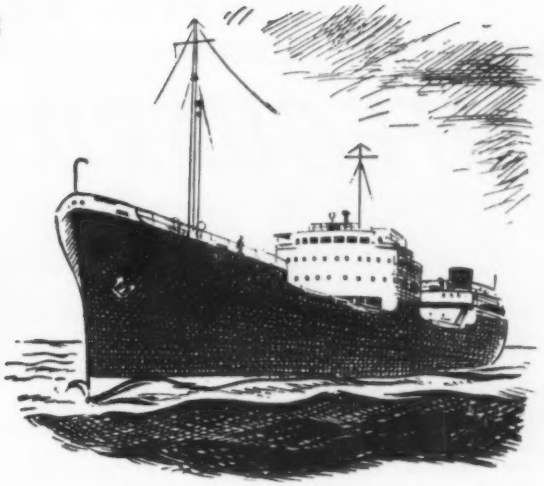

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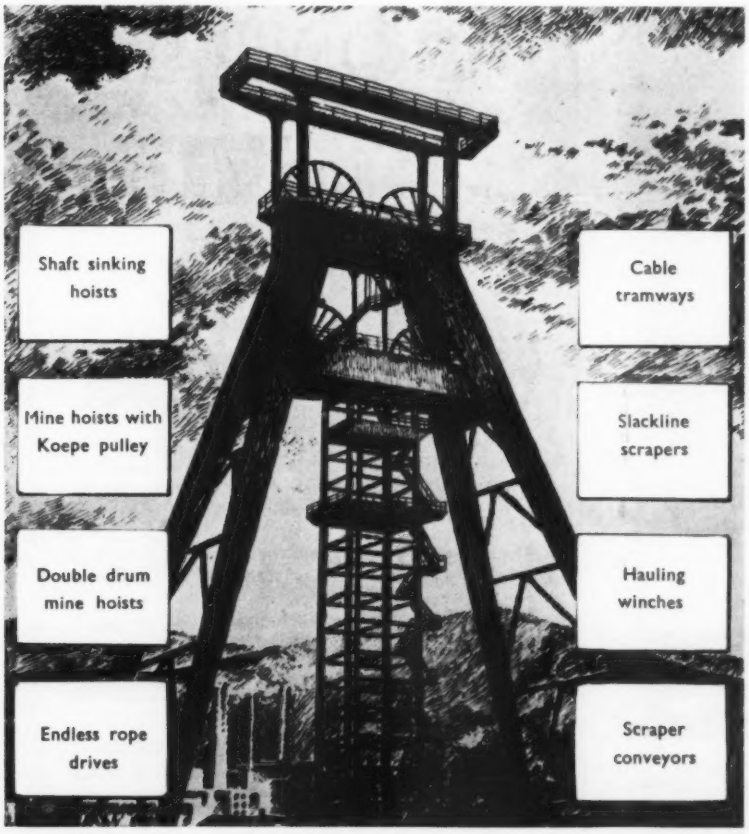


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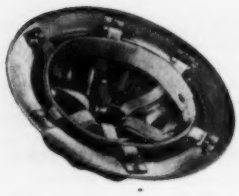

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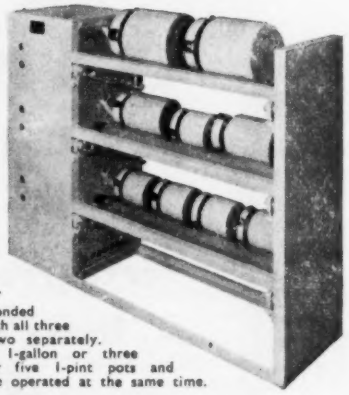

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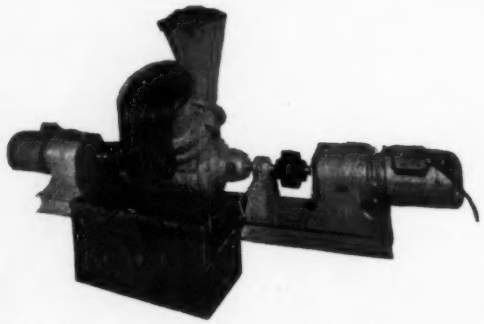

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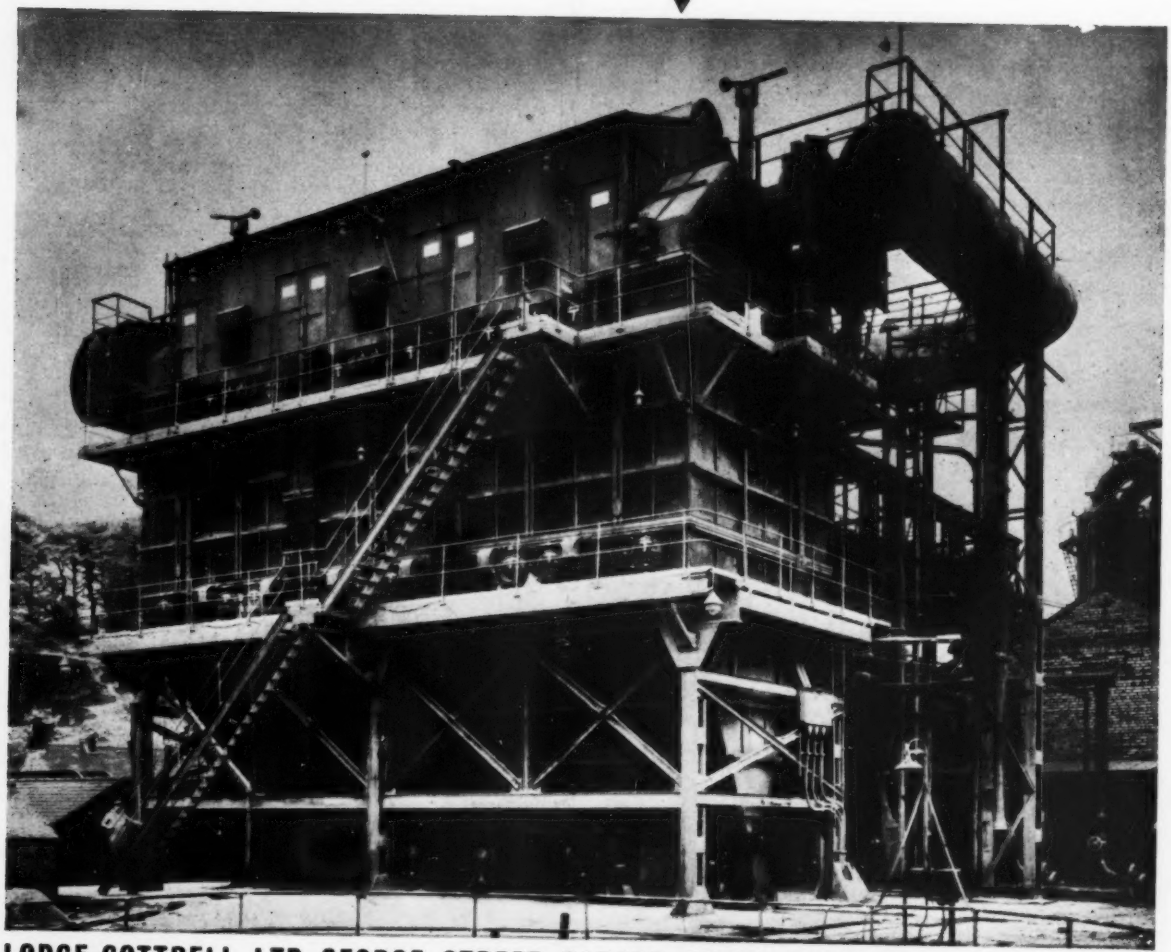

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